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ACCIDENTS FROM BROKEN BRIDGES.

BY WM. S. HUNTINGTON.

[Written for the AMERICAN RAILROAD JOURNAL.]

THE accidents from broken bridges in the United States in the last ten years are reported at 300, which, to say the least, is not flattering to American railway management. While it is certain that a considerable portion of these mishaps were purely accidental, it is a fact that the larger share of them might have been prevented by the exercise of ordinary precaution; and more correct views of true economy. Bridges have failed from being partially burned and not discovered in time, or from sudden freshets undermining their foundations, or from contraction of rods and bolts in severe weather, or some hidden defect in some member which had escaped the closest inspection. Such have been the causes of many accidents for which no one was responsible, and may be regarded as accidents or misfortunes that come in the common course of events, and cannot be prevented. But when a bridge fails from age or neglect, malconstruction, overloading, or any cause directly under control of the proper officials, who have the means of prevention at hand, it may not be regarded as accidental, but the result of incapacity, false economy, criminal neglect, or "cussedness," which is the proper word in most cases of bridge failures.

Probably one reason for so great a number of broken bridges is that they have been subjected to rougher treatment than they were originally designed for, and their factors of safety exceeded by a greatly increased weight of locomotives and car-loads. While within a few years the weight of locomotives has been more than doubled, and a standard car-load of ten tons increased to thirty tons or more, bridges have not been brought to a condition to carry these excessive loads; hence the numerous failures of these neglected structures. A great many roads were built for light traffic, and have since been leased by trunk lines that put on heavier rolling-stock and heavier trains than the cheap structures could bear, and it is not considered a sound policy to go into expensive repairs and renewals on leased roads.

It is the practice on some roads to renew bridges after a certain amount of service, though there are no apparent signs of weakness. This has more special reference to wooden structures, although engineers of the more carefully managed roads consider it the correct thing to renew iron bridges before any outward signs of weakness appear. To some of the slipshod economists this may appear like a reckless waste of earnings, but it is noticeable that this so-called kind of extravagance in expenditures leaves cash in the till, while the "guess-it-will-last-another-year-with-a-little-patching-up" management goes borrowing.

Scientists tell us of the "fatigue of metals," and practical men are well aware of the weakening effects of long continued strains and vibrations, and expansions and contractions from heat and cold; and when iron bridges have reached a respectable age, there is much uneasiness felt in regard to their safety. The length of time an iron bridge can safely do duty varies from fifteen to twenty-five years, according to the quality of material, style or plan of construction, length, and amount of traffic, and location; extremes of heat and cold being destructive agents. At high temperature, when every member is expanded to its maximum length, a general screwing up is necessary for safety, and this tension, together with the powerful strain of contraction in severe weather, is the cause of many failures, not only of iron but of wooden bridges which are supported by iron rods. On the slacking and tightening of these rods at the proper time depends the safety of bridges in a great measure, and closer attention to this subject would have shortened the list of bridge accidents wonderfully.

Experiment has shown that a certain number of strains and vibrations crystallizes iron and steel, and when this takes place there is no longer any safety in the material. Cannons are condemned after a certain number of discharges, although they may appear sound; and on English roads locomotive parallel rods are thrown aside after six years of service, and cast car-wheels are considered unsafe after a certain mileage, and their use after that contributes largely to the causes that place roads into the hands of receivers. This applies to bridges, and it was a knowledge of this property of iron and steel that led a daily newspaper, a year or more since, in revenge for some fancied wrong on the part of the Manhattan Elevated Road, to injure the business of that road by warning the public that the entire structure was liable to fall to the pavements at any moment, by reason of crystallization and chronic weakness, engendered by a constant vibration for a period sufficient to render the entire fabric a mass of rottenness. According to this newspaper, there was not a train on the road that was safe for a moment, and it was only a question of a very short time when there would be a general smash, after the manner of the "wonderful one hoss shay." But Mr. R. J. Sloan, the chief engineer of maintenance of that great work, had anticipated the attack, and had been actively engaged for some time in adding strength to the structure, so that in reality the road was safer at the time the great calamity was predicted than at any time since its completion; and, under the present system of thorough inspection, and timely repairs and renewals, there is no safer place for a person than on any train on the "L" roads. The same practice would render bridges safe, and engineers will do well to "stick a pin there."

One suspected cause of bridge failures, especially of large structures, is a jealous rivalry among engineers. An engineer is placed in charge of a road on which his prede-

cessor has erected some bridges of his own design. The new-comer builds some after his plans, and, as they are pets of his and his friends, they are tenderly cared for in the minutest particular, that they may bring fame and fortune, while the others are left out in the cold uncared for, and signs of failure give the engineer a sort of pleasant anxiety, such as he would experience on hearing of the illness of a rich uncle. Just how many bridges have gone to destruction through this criminal neglect is not known, but it is certain that jealousy was the direct cause of the most horrible bridge disaster that ever occurred on this continent. A remote cause was a mixture of incapacity, malconstruction, and mulish stubbornness on the part of the originator and builder, a circumstance which the builder's successor sought to turn to his advantage. The engineer who had charge of the road at the time of the accident was well aware of the faulty construction, and knew very well what repairs and changes were necessary to render the bridge safe, but this he neglected from the first, and, later on, his attention was frequently called to needed repairs, which warnings were unheeded; and shortly before the crash he was informed that the bridge was actually unsafe, and required his immediate attention, and to this he paid no attention. When finally the crash came, he committed suicide, preferring death rather than face the censure that he knew was in store for him, and the prospect of conviction for wilful murder. It was clearly shown at the inquest that the bridges of his own construction were nursed and cared for in the slightest particular, and he could not face the evidence and the awful responsibility. Singularly enough, the designer and builder of the bridge committed suicide some years after the disaster. He completed the bridge in direct opposition to the advice of engineers of more experience than he in iron bridges, and it was a matter of dollars and conceit, braced up by a position which gave him authority, the abuse of which, and its results, literally worried him to death; and there is good reason to believe that other consciences are not clear on the score of strict attention to the safety of bridges.

It is frequently remarked that engineers should not be blamed for the failure of poorly constructed bridges, inasmuch as they are forced down to prices below which an honest bridge can be built, and they must employ shoddy material and make use of all the tricks known to the profession, or lose money. A few years since a large iron bridge on a New England road, broke down while under the initial test. The contract was awarded at a price far below what any reputable builder would undertake it for. In such instances—and they are not a few—everyone connected with the management should share in the blame. In the first place, no bids should be accepted below a price that would enable the builder to do a safe job, and in the next, no builder should undertake a job below a reasonable price. If he does, all are alike responsible for failures or accident, but if he is paid a full price and turns out a poor job, he alone is responsible for all damage resulting from his trickery,

Wooden bridges are less liable to fail from hidden defects in material than those of iron, except from the effects of age. Neither are they injured by vibrations to such an extent as iron, owing to the elasticity of wood when in a sound condition, but their strength is greatly impaired by age, and, like iron, they are not safe without thorough repairs and timely renewals. Inspectors are frequently deceived by appearances in examining old wooden bridges, and outward appearances are not to be trusted. Timber that has been kept covered, and well protected with paint, will give no indications of decay on or near the surface, while, in boring to the center, dry rot may be discovered, and this is more to be feared than any other destructive agent. It lurks beneath a sound exterior, and can only be detected by boring, and should be frequently looked for. A little more vigilance and more sensible views of economy will shorten the list of bridge accidents.

RAILWAY LOCATION.

BY CHARLES SEYMOUR, C. E.

[Written for the AMERICAN RAILROAD JOURNAL.]

THE question of locating a railway, so far as the engineer is concerned, is one of route in the field. Sometimes the main terminals only are defined by the projectors through their board of directors, when it devolves upon the engineer to present the merits of rival lines as to cost, length, alignment, grades and prospective traffic.

In order to study the country the engineer should make a careful personal examination of the different lines proposed or suggested, using freely all maps of the localities through which the lines pass that can be obtained, and such other information as he can secure from the residents of the country. He should determine the direction of main and secondary water-courses and ridges, and the location of all break-downs or depressions in the ridges that must necessarily be crossed, and also in those running parallel with line as sometimes it is expedient to cross from one valley into another running nearly parallel with it.

I have found it to be a good plan to ride over the country on horseback with a mountain barometer in my pocket, which is sometimes very useful, and accompanied by such citizens of the country as desire to act as pilots. New railways are popular, and plenty of volunteer pilots will be on hand, or men familiar with the county can be hired as guides. When the engineer has made himself familiar with the different probable routes, which can be done very rapidly with such aids as indicated, he will then be prepared to put a corps in the field and run his preliminary lines.

The first horseback reconnoisance will give the location of the important guiding points to run to, such as business centres, lowest gaps of ridges to be crossed, best river-crossings and valleys subject to least overflow, so that the engineer will be well prepared to act as pilot in the more minute instrumental locations, and he can keep the surveying party furnished with full instructions to enable them to proscecute their work intelligently and without any loss of time.

During the progress of the surveys, the engineer in charge should carefully study and examine the country for some considerable distance on each side of the line, so as to be prepared to run deviations that may invite attention.

All lines should be located with a view to the cheap working of trains, by obtaining ground that will admit of

the lowest grades and least curvature. If economy in construction is essential, it should be obtained by using temporary grades to save work, and pile or trestle structures to save the heavy cost of stone-work, but in no case should the true location be sacrificed for present economy as a railway when constructed is a fixture. If the location is not a sound one it is difficult to change afterwards. The additional expense is almost prohibitory, and interests developed by the railway would have to be sacrificed. If the location is all it should be, temporary grades can be reduced and timber can be substituted by stone and iron or steel.

I have found the compass the better instrument to use in preliminary work, as so much more ground can be gotten over in the time than with a transit. The transit has no advantage at all over the compass unless the preliminary lines are run with perfect accuracy. To do this, not much more than one mile can be made to two with the compass. With the same cash outlay, twice as much country can be instrumentally examined with the compass than with the transit, and the engineer is better prepared to select the true location.

NEEDED IMPROVEMENTS.

BY E. P. WILLIAMS.

[Written for the AMERICAN RAILROAD JOURNAL.]

AFTER a recent conversation with a director of one of the trunk lines, I made the following notes and suggestions which, I think, may be useful to the JOURNAL'S readers.

IN putting the road in a proper condition a larger axle must be adopted, 3½ inches being entirely too small. To this diameter one can easily trace the trouble they have with hot boxes. It would certainly be best to adopt a 4-inch journal, and make the axle long enough so that the plates of the cast-iron wheels may not be suddenly curved, to bring the tread into its proper place. Some persons will be surprised, no doubt, that the Master Car-Builders' Standard Axle is not recommended. The reason is not difficult to discover. When that axle was adopted it was a compromise. Many of the best men in the association thought the diameter of the journal then should have been four inches. Weights have increased since that time, and four-inch journals are more nearly correct than 3¾. The Master Car-Builders' Standard is much too small in the center, and is shorter than it should be for a cast-iron wheel of the best form. Finally, no two roads seem to have adopted precisely the same form of the Master Car-Builders' Standard Axle. As another standard will, no doubt, be proposed within a few years, the road may as well have the advantage of a large size, until the association make their new proposition. If the road adopts the 42-inch wheel for passenger equipment, it must have a large axle. The leverage exerted by these large wheels amounts, in some cases, to 25 per cent. more than that of the 33-inch. Several years ago, Mr. Garey, when president of the Car-Builders' Association, found that the standard axle bent in the middle, under an ordinary load, so that the wheels spread at the top. If the axle was too weak for the 33-inch wheel, something stronger is needed for a 42-inch.

I think we should remember, in regard to all the standards, that they are only a means to enable roads to conduct their business with economy. When they hinder progress, or stand in the way of efficiency, they had better be quietly ignored. Standards are very valuable, but they are not often found to be sufficiently accurate in practice to enable interchange to be made by a number of roads. It is best to have the proposed standards carefully investigated by the master car-builder. If there are discrepancies reported, it is certain that some point has been overlooked.

The Master Car-Builders' Association proposed a standard wheel-tread at their last session. A wheel made after this pattern, could not be put on an axle and made to conform to the other standards which they had already adopted. This was evident to every experienced man, and the wheel was rejected. The proposed form was good but could not be adopted till some of their absurd standards had been changed. On this account I would advise a careful investigation to be made of every standard proposed, before considering the question of adoption.

The standard house or box-car is not worth a moment's thought on the part of the management of the road. I believe we are on the eve of a revolution in freight-car building, and to attempt the introduction of a new standard, to which no one will adhere, is a waste of time. The coming freight-car will be of iron or steel. If the gas-wells do not fail it will be built in Pittsburgh. We need not trouble ourselves about its pattern, for that must be decided by the convenience of manufacture to a large extent. I expect, at some time, to buy my cars as I do my wheel-barrows. I shall select, from the styles offered, those that suit my needs and are cheapest, and then shall have no further care in the matter.

I have on my road a few of those passenger-cars with the spliced sills, and I confess I feel anxious every time I see one go out on a train. I asked one of my young men to figure up as nearly as possible the actual strength of one of the "ship splices" used on them. He could not estimate the stiffness very accurately, but found, by measurement, that fully half of the effective area of the timber was destroyed in making one. The cars of that build, which have gone into accidents within the last year, have been destroyed in a manner which convinces me that they have no strength in the floor frame. The builders never discovered that a spliced sill was better than a single stick till long cars were called for, and long sticks grew scarce. It is the increase of price for the long sills that makes the contract-builders such strong advocates of splicing.

When cars are ordered, specify single sticks for the sills, and have the master car-builder at the works to see that single sticks, sound, free from sap and shooks, are put in. With spliced sills, these long, heavy parlor-cars will have to be carried by the truss-rods, and will have no margin of safety. They are liable to be broken if the cars run off the track in the yard at any considerable speed. Could give chapter and verse if it was necessary.

In buying sills, my rule is to get what are needed for the passenger and baggage-cars, and then pay for them like a little man afterwards. Mr. Watrous, of the New Haven road, can give most railroad men points on this. There is no difficulty in getting sticks of sufficient size and length, free from sap, knots, and shooks. The trouble

that is met comes from the fact that people are afraid of the price. It makes very little difference whether one pays $45 or $65 per thousand for the six most important timbers in a passenger-car. If one must practice economy on the lumber bill, do it at some less vital point. The difference between the very best and very common sills will not at the present time amount to more than $50 per car, and at some shipping points it is even less. This is too small to be worth saving at the expense of the strength of the car, and possibly human life.

SUBURBAN TRAFFIC.

ONE great requisite to a successful handling of this class of business is properly-designed and constructed motive-power. It is required of an engine for suburban business that it shall be able to pick up its train promptly, and get under full headway within a short time and distance from leaving a station. Without this ability there is too much loss of time in the numerous stops which are necessary. The engine, to accomplish this, should not be heavier than the traffic demands, the smaller engines, as a rule, being quicker in getting under full headway; and it should have a valve motion which will give the freest action of the steam in the cylinders. A sufficient weight is needed on the drivers to prevent slipping, and this can be well accomplished by some form of a tank engine. It is also desirable that the engine should be constructed to run equally well in either direction, so to avoid the necessity of turning. This is an important point in view of the short time allowed for handling suburban trains at terminal stations. The arrangements for combustion and the fuel used should be such that the least trouble would be experienced from sparks or smoke. We have seen many engines in use, at various places, which fully meet all the requirements noted above. In the desire, however, to obtain economical engine service, we should avoid using too small or too light engines. We have heard of this fault in places where otherwise the service seemed all that could be desired, and it can be readily seen that such faults result in loss of time and increased expense in handling the train.

The cars are the next important consideration, and upon their construction depends much of the comfort of suburban patrons. The full requirements for successful operation seem to be met by the cars running from several of our large cities, but a sketch of the requirements may not be amiss. The cars should be a slight as possible, consistent with strength and safety. A lighter construction may safely be used with such cars, as they do not make long trips away from home, as in the case of ordinary coaches, and they are not exposed to the longitudinal strains from the heavy sleeping-cars and long trains of the through traffic. The lighter cars also allow of the prompt handling of trains needed in this class of business. The cars for this traffic should be well lighted both by day and night, so that newspaper reading, so dear to the American mind, can be easily carried on. The heating should be ample, as the frequent stops necessitate much opening of doors. The inside finish should be light in color, simple in character and of such a nature as to allow of quick and thorough cleaning of the cars. With this class of car, convenience and neatness is more called for than elaboration of ornament or lavish expense. The arrangement of seats should be such that the car can be filled or emptied in the shortest possible time, thus shortening the stops at stations.

The stations should also be arranged so that the passengers will be protected from the weather, whether entering or leaving the cars. A certain amount of taste in the arrangement and ornamentation of stations adds to the comfort of the patrons of the road, and aids in building up its business as against towns situated on other lines.

The lighter rolling-stock used for suburban business allows of a larger percentage of paying load to dead weight than can be reached in the passenger-trains in ordinary local or through traffic. This percentage, with good handling of such traffic, can probably be made fully twice that of ordinary trains. On the other hand, it is not well to try to carry this proportion too far by carrying an extra large number of cars to one engine. Such a train becomes unwieldy and hard to start and stop.. There is another argument against long trains in suburban service, and that is the difficulty with which the conductor can get from end to end of the train, so as to collect all fares between the frequent stops made. The loss of revenue from this source may be considerable in amount, though perhaps not in percentage of the total amount collected. When all fares are paid before entering the cars and the tickets taken by gatekeepers this difficulty is somewhat obviated. It seems to us, however, that all things considered, five cars, each capable of seating as many passengers as an ordinary coach, make about the size of train that can be handled most efficiently, comfortably and economically in all respects. In addition to the gain from heavier relative loads the cheaper and lighter style of car resulting in lighter trains gives to a certain extent less expense for engine, car and track repairs.

There is also a certain amount of saving, as we have before remarked, because of the freedom from soliciting and advertising expense, which forms so important a factor in the through business. As regards station or terminal expense, there is probably as large an amount incurred for the same quantity of suburban travel as for the regular passenger business. The numerous details involved through the wants of a large suburban constituency necessitate much petty work on the part of officials, and considerable storage and waiting-room at stations. Other items of total operating expenses are probably not much affected by handling suburban business, except that if such a business can be built up without injuring the strictly local traffic there is a larger number of travelers who will help reduce the general or fixed expenses on other passenger business.

In order to encourage new business on a suburban line, and to develop the growing villages on the outskirts of a large city, a road has to do a certain amount of what might be called "pioneer work" in running trains and furnishing station facilities in advance of what seem to be the actual needs of the district traversed. Such pioneer work has, of course, to be entered into with much judgment to avoid any expense that may not result in future gain, but there is no doubt that a certain amount of this sort of encouragement is necessary and has in the past been attended with good results.

Another important feature which concerns the comfort and economy of those living in the suburbs of a large city, is some complete system of what might be called a parcel express by which the transfer of ordinary packages between the town and country stations can be done cheaply and promptly. While suburban residents can often get country products cheaper and fresher than in town, a large city offers numerous advantages in the way of purchasing which can not be possessed by any suburb. While on one hand it is not advisable for the road to discourage the carrying of hand-packages by passengers as ong as the comfort of others is not disturbed, yet, on the other hand, there is a large amount of traffic to suburban stations that must of necessity go in the baggage-car. While the policy of the road should be liberal in this direction there seems no reason that patrons should expect to have their purchases carried free.

Some system can easily be devised by which articles left at either the country or city depots will be carried and cared for at low rates which would yet bring in a certain amount of revenue to the road. Some arrangement should be in force by which packages could be received from or delivered to the houses and stores at the country town. In the city there are existing arrangements for doing this. The average suburban resident has generally moved out of town on the score of economy and as a rule does not possess a team of his own, so that some cheap means of getting packages to and from the station is a necessity. When the railroad has a contract with an express company for its regular parcel traffic this suburban business, including deliveries at both ends, can be handled well by the express company. The railroad managers should see, however, that liberal rates are allowed their suburban patrons and that collecting and delivering facilities are as perfect as possible. The parcel feature of suburban business has reached a very complete shape in England and forms no inconsiderable portion of the service of the roads.

The question has been raised whether these liberal facilities for parcel traffic would not hurt the prospects of local stores in the villages on the suburban lines. While there are always items of daily supply which are constantly needed at short notice, there will also always be a need for stores of some magnitude in the suburban stations. It is an impossibility, however, for them to expect to supply the total wants of suburban residents, as the proximity of a large city always interferes with the development of ordinary stores in the adjoining towns. While a road, by discouraging the parcel traffic, may, to some extent, aid the local stores, the best interests of the many will be served by the extension of the best facilities for obtaining needed supplies in the city. If the country store is able to offer equal inducements, either in prices or quality, the convenience of near supply will generally give it a fair trade, regardless of the city competition.

The wants of suburban business, and the various features to be considered in its successful development, both as regards profit to the road and the comfort of its patrons, make this class of traffic to a large extent a distinct branch of the service. The features of both passenger and freight traffic of this nature vary in many respects from the ordinary traffic of the road, and need different handling, to a certain extent. Where this class of business is of large proportions on any line, it is questionable whether a separate officer or department to take immediate charge of the traffic is not advisable and necessary. Such an official has been appointed in some cases and the results arrived at are quite gratifying. Whether this is done or not, it seems evident that the question of suburban traffic is daily becoming more important with the growth of our western cities, and will demand more attention from the management of our roads.—*Railway Review.*

RAILWAY REGULATION IN ENGLAND.

THE introduction of a new scheme of railway regulation in the British House of Commons, within the month, is an event deserving of more than a passing remark. It goes to show that, in spite of an impression to the contrary long prevalent here, perplexing questions of railroad policy have not ceased to exist in England, and that further intervention by the state is now felt to be necessary for the settlement of vexatious controversies. Measures of this kind are not new in England. As long ago as 1840–42, the Board of Trade was authorized to exercise certain powers now usually devolved on railroad commissions. In 1846 a railroad commission was appointed which continued in office for five years, but its powers were too limited and it left little mark. During the forty years that have elapsed since then measures of railway regulation have been frequent. The law establishing the existing railway commission was passed in 1873. The commission was to consist of three members, of whom one was to be a railroad man and one a lawyer. It was authorized among other things to decide questions arising under the railway regulation acts, to arbitrate between railroads in a variety of cases, and to secure publicity of rates. On questions of fact there was to be no appeal from the decision of the commission; an appeal was given on questions of law. The authority of the commission expired by limitation in 1878, but it has since been renewed. High hopes were entertained of the commission, and the expectation that its existence would of itself put an end to the most perplexing questions seemed to be borne out by its reports, but observers who looked beneath the surface became aware of the existence of difficulties which the powers of the commission were not able to reach. The commission, as an acute American critic, Prof. Hadley, has pointed out, "was not an executive body, but to all intents and purposes a court of law," and a court, too, whose action was not final. The railroad men seized upon this point of weakness, and by a course of persistent appeals did much to neutralize the commission's action by deterring complainants. These facts were brought out by a parliamentary investigation in 1881-82, and since the publication of the result of this inquiry the project of the increasing powers of the commission has been brought forward from time to time.

Under the plan submitted by Mr. Mundella, the president of the Board of Trade, the railroad commission is made a permanent court of record, whose decision on matters of fact is to be final, but from whose decision on questions of law an appeal will lie to a court of appeal. The place of chief commissioner is to be filled in England

by a judge of the High Court of Justice, in Scotland and Ireland by judges of a corresponding grade. The other two members are to be laymen. Every order of the commissioners is to have the force of a judgment. The jurisdiction of the commissioners is to extend to all questions respecting tolls, rates or fares, and they are to be given power to award damages. The constitution of the commission, it will be seen, retains many points of resemblance to that of the present one, though the powers of the new commission are more extended. The bill requires all railroad companies to furnish the Board of Trade from time to time with a statement of their rates and charges, together with a schedule of maximum rates, and a statement of the nature and grounds of the terminal charges proposed. Public inquiry will be made regarding the existence of any dissatisfaction with the companies' proposals, and where substantial grievances are proven the schedules will be revised by the board under the control of Parliament. Where unequal charges are shown to exist the companies may be called upon to show that the inequalities are justified. A novel feature of the bill is the attempt to make of the Board of Trade a sort of mediating body by providing that where complaint is made to the board of unfair or unreasonable charges, that body may strive to settle disputes amicably. Mr. Mundella laid much stress on the importance of negotiation and arbitration in the settlement of railroad disputes, and particularly referred to the experience of the United States as illustrating the advisability of mediation. Upon this point the president of the Board of Trade quoted *Bradstreet's* as showing that success has attended the efforts of the railroad commissioners to bring the railways and the people together in friendly discussion. There is nothing, he thinks, to which the railroads are so amenable in America as public opinion, and he hopes that the same will be proved to be the case in England.

There has been, naturally, some criticism as to the merits of certain features of the bill, but as a whole the measure seems to have the support of those best qualified to speak on the subject. Sir Bernhard Samuelson, a specialist on the subject of railway rates, is quoted as saying that under the bill "there is promise that the grievances of those interested in railway rates will be remedied." There can be no doubt, at any rate, that under the proposed law the railroad commission will be stronger in itself, and will have freer hand to carry out its purposes than at present. Under the proposed law the commission, instead of having a precarious tenure dependent upon renewals for short periods, will be a permanent body, thus gaining in stability and dignity. It will have power to move about the country, so that the barrier of inconvenience will not operate to shut out complaints. Beyond this the power of revising schedules of rates is secured to the Board of Trade under the control of Parliament. This is a power which, though often claimed, has been but rarely and very sparingly exercised. It is one too, in the exercise of which the greatest care and circumspection will be necessary. Lastly, there is the machinery for securing publicity in respect to rates and charges, and in reference to the recommendations made by the Board of Trade as a mediator in cases of dispute. It cannot be doubted that the existence of this machinery will in many cases render unnecessary the exercise of the other powers of the commission, and will in itself go far to do away with many of the abuses which the new measure is designed to reach.—*Bradstreet's.*

Railways in China.

THE House Committee on Foreign Affairs recently received from Secretary Bayard the following letter from Minister Denby relating to the effect of the annexation of Burmah and the establishment of overland routes to China in relation to the building of railways:

The annexation of Burmah by Great Britain gives new interest to the railway question in the Far East and the establishment of overland trade routes with China.

Three great European nations have been gradually carrying their frontiers nearer to China. Russia has been pressing forward from the north and west by annexing the banks of the Ameer and a large portion of Kirin, which makes her conterminous with Corea, on which latter country she is also supposed to have designs, and by the position she holds at Kashgar and at several other points in the west of the new dominion.

France comes next in the field from the south, and hopes that she may establish her supremacy in Tonquin, and open to her commerce the Red river and acquire the trade of Western China.

England, which seemed the last in the field, has by a bold stroke of policy assumed the foremost place, and acquired, by the annexation of Burmah, the only trade route existing between Southern Asia and China—viz.: the Irrawaddy and Bhamo route, and makes still more probable the eventual building of a railroad connecting British India and China.

Russia, in the meanwhile, is pushing on, at the rate of several miles a day, her Central Asian railways, which will shortly reach Merv, and in the near future Kuldja, thus greatly facilitating the defence of her immense frontier. But the project which concerns her ultimate prosperity most nearly is the system of Centrial Asian railways designed by M. de Lesseps. This line, destined to unite the extreme west of Asia with the extreme east, starts from Astrakhan, passes through Khiva, Bokhara, and Samarcand into Chinese Turkestan; touches at Tang-Kissar, Kashgar, and Yarkand; skirts Lake Lob, and thence through outer Kansule, down to the Kan Valley, to find its terminus in Wuchang or Kankow. The military railways already established or in construction by Russia are partly carrying out this gigantic scheme, and if the words of Tso Tsung Tang on the pressing necessity for China to establish in the near future a railway to her northwestern frontier be borne in mind by China, a colossal railway system may be established sooner than we expect.

In this connection it may interest the department to know that Gen. James H. Wilson, who, at the request of Li Kung Chang, has been examining the country near Tien-Tsin in view of the ultimate establishment of railway communications, left for Chinkiang, by way of the Grand Canal, to report on the practicability and cost of a railway along this line, and also on the condition and necessary work to be undertaken to control the Yellow river. Gen. Wilson has with him several able surveyors, and was offered a military escort by the Viceroy, which he, however, declined.

Coal in India.

IT appears, as shown in an official statement lately published in India, on that country's moral and material progress that the use of Bengal coal, which is general in that province for industrial purposes, is gradually extending throughout Northern India. Bombay continues to draw its support from England, the freights for English coal sent out in exchange for cargoes of raw produce ruling very low. But with the extension of railways and the reduction of freights in the coasting trade, India coal may, it is stated, before long compete successfully with imported coal, even in the Western Presidency. In Bengal, only three out of the numerous coal fields known are actually worked, the principal of which is the Raniganj. There are seventy-eight collieries, and the total out-put was, in 1883–84, 1.200,957 tons, or more than double the out-put, 532,846 tons, of 1882–83. Outside Bengal there are only two collieries, those of Mohpani and Warora, in the Central Provinces, though it is stated that workings were begun in the native State of Rewah, toward the close of the official year. An attempt to open a mine at Lakading, in Assam, has also recently failed. The Assam coal fields, however, which have just been prospected, are considered very promising. They cover a plateau with an area of thirty square miles. The number of people engaged in mining in India is something over 23,000, but the return is admittedly inaccurate. Iron has been found in almost every district in India, and is worked with charcoal by native agency. It is expected that the growing scarcity of fuel and the competition of English iron will displace the indigenous methods by European manufacture on a large scale. This has not yet occurred. The chief native foundries are in Bengal, the Punjaub, and the Central Provinces.

American Locomotives vs. European.

IN a letter to the Department of State published in the Consular Report for January, the United States Consul at Chemnitz, Saxony, says:

"Recently the Roumanian Government invited bids for contracts to furnish 212 passenger-coaches, thirty tender-engines, and twelve express-train engines, together with more than 300 freight-cars, and other rolling-stock for railways. There were many bids from various parts of Europe. I do not know whether those engaged in this industry in the United States were apprised of this or not, but I do know the superiority of American rolling-stock, and regret to say that there was no effort put forth from the United States to supply the Roumanian Government with these articles.

"It is my firm belief that, with a little effort on our part, these contracts might have fallen to the United States; as it was they have been secured by the vigilant and wide-awake Germans, who have captured *en bloc*. The contract for the engines was awarded to the Hanoversche Machinenbau-Geselschaft, at the price of 1.14 francs gold per kilogram of metal used. At this rate the price of a tender-engine would be about 24,000 francs in gold, or more than $4.000. The locomotives to be delivered at Bucharest. The contract for the twelve express engines fell to the Maschinenfabrik Linden, of Hanover, at 47,200 francs, and the contract for the freight-cars was awarded the Deutz firm, of Zypen & Charlier, the bid being 550,000 francs, the highest being 880,012 francs.

"Americans must not judge of their ability to compete with others in such articles by the price I have quoted here. The question with them would be if they could get a better price for a superior article, and I am strongly of the opinion that this question would have been decided in their favor. Why should it not have been, when Russia, Roumania's next-door neighbor, has adopted the American railway system, and has equipped her railways with American rolling-stock, which has proven in every respect in the highest degree satisfactory to the authorities; or in a contract of this kind, the elegant finish and trim appearance of the American locomotive, which is strongly appreciated in the United States, might have been abandoned and the European taste, or rather want of taste, catered to?

For example, a European locomotive has no cow-catcher; many of them have no jacket, and many have no cap, and there are many other appurtenances to an American locomotive that would be considered superfluous for a European or Roumanian, that would reduce the cost of their construction for this country from 7 to 10 per cent. less than that would be required for one of our railways. I hope it is not yet too late for Americans to give this subject their attention, and that they will lose no time in doing so. Of one thing they may be sure, and that is that they have the strong claim of superiority for their machinery and rolling-stock, which they can easily establish, and which is the best they could have to overcome competition.

Second-Class in England.

THE Liverpool *Post* says: The second-class traveler on English railways is gradually being improved out of existence, or, to put it more accurately, third-class traveling has been made so exceedingly comfortable, snug, and expeditious that it is rapidly monopolizing all the business. First-class compartments there will always be, but their patrons will remain few. The compartments designed for the middle-class of the traveling public have been entirely eliminated on one of our main trunk lines, and they are fast disappearing on another. The Great Northern is following the example of the Midland. It is announced that with the new year the first named company will cease to issue second-class tickets between their stations in the West Riding, and between those and Doncaster. On the main line second-class accommodation will still be provided, as it will also be between stations in Yorkshire and stations on the main lines south of Doncaster. This change has already been effected in other parts of the Great Northern system. On the first of May last, the company ceased to issue second-class tickets to the Lincolnshire loop lines, and between Grantham and Boston, Bourne and Spaulding, Grantham, Nottingham and Derby, and Newark and Leicester. The reason for this extinction of the second-class traveling accommodation is not far to seek. It does not pay the companies to run carriages which are never filled, unless it be with emptiness. It is the once despised third-class traveler who is now the paying feature in the passenger returns. Twenty years ago no treatment was too bad for those who had the temerity

or courage to venture to book themselves third-class. To-day the third-class passenger is an object of profit, and he gets all in the way of comfort and celerity that he can possibly desire. If he is badly treated anywhere, it is in remote districts where competition is absent, and where railway directors have not yet learned to treat with respect and consideration the most profitable of their customers. The old taunt heard in Germany that only princes, Englishmen and fools travel first and second-class can hardly apply to the modern Britisher, who has been quite content to follow the revolution in management which tends so thoroughly to break down class prejudice.

Railways in Spain.

THE aggregate revenue of the Northern of Spain to February 25th, this year, amounted to £297,752, as compared with £323,646 in the corresponding period of 1885, showing a decrease of £25,894 this year. The aggregate revenue of the Lerida, Reus, and Tarragona (which is worked in association with the Northern of Spain) to February 25th, this year, was £9,236, as compared with £10,766 in the corresponding period of 1885, showing a decrease of £1,530 this year. The aggregate revenue of the Asturias, Gallicia, and Leon (which is also worked in association with the Northern of Spain) to February 25th, this year, amounted to £43,940, as compared with £36,438 in the corresponding period of 1885, showing an increase of £7,502 this year.

Indian Territorial Railways.

AS appears by a late issue of the *Boston Transcript*, there are pending in this congress nine propositions to grant railroads right-of-way through the Indian territory, of which about half are in the interest of Boston capitalists. The Kansas City, Fort Scott and Gulf desires to run across the northeast corner of the territory, entering the forbidden country just south of Baxter Springs, in Kansas, and pursuing a favorable route to Fort Smith. The Kansas and Arkansas Valley wishes to enter at Fort Smith and extend in a northwesterly direction to Arkansas City. The proposed route of the Wichita and Arkansas Valley is from a point near Lisbon, in Chautauqua county, Kan., in a southerly direction, along the general course of the Caney river, to near its junction with the Verdigris; thence southeasterly to Fort Gibson; thence to the boundary of the territory, near where the Arkansas river crosses into the State of Arkansas. The Southern Kansas, if its bill passes, will enter the territory near Arkansas City, and follow a practicable route to Forth Smith. The company binds itself to build one hundred miles within three years, and it further binds itself to observe strict neutrality on all questions or movements looking to the extinguishment of the Indian titles. The St. Louis and San Francisco right-of-way bill is already so far on its way that it is almost as good as passed. This bill authorizes a route through the Choctaw and Chickasaw nations, from Fort Smith, in the direction of Paris, Tex. John Scullin's road, the Denison and Wichita, is to be coustructed from near Denison, Tex., across the Indian territory in a northeasterly direction until it strikes the Frisco's Paris route. The Pacific and Great Eastern comtemplates a line from near the town of Cincinnati, in Washington county, Ark., due west through the entire length of the Indian territory, emerging near the thirty-sixth parallel of latitude. The Fort Worth and Denver City wishes to extend northward across the territory to the southern boundary of Kansas, entering the territory somewhere near the mouth of Big Beaver creek and the mouth of the north fork of the Red river. The St. Louis, Baxter Springs and Mexico wishes to get in near Baxter Springs and build south to the Texas boundary, with a branch extending to the western boundary of the territory.

Trees Along Railways.

AT this time the subject of protecting railway cuts from the possibility of being filled with snow should attract the special attention of managers, says a correspondent in the *Farmer's Review*. In riding over thousands of miles of Russian railways in 1882, I was struck with the perfection of their system of shrub and tree planting to arrest snow at all points where banks could possibly form. I was told the system had proven a success in that land of blizzards, deep snows, and frequent and deep cuts on the rolling prairies.

Mr. G. Doppelmair, of Kiev, Russia, who has given much time to this kind of work, writes as follows: "The trees for arresting snow are planted 25 to 30 feet from the rails, in 5 to 7 lines. Lines 5 feet apart and the plants 1½ feet apart in the rows. The three inner lines are planted with trees, and the outer ones with conifers, or shrubs.

"This system of planting protects very perfectly our roads during the gales on the steppes. The snow is whirled in heaps back of and among the trees and shrubs, and fails to reach the rails to a serious extent."

In the west, box elder will make the best tree for the center rows, and the outer rows can be made of such conifers as do well on high ground in different parts of the west. *Pinus pumilio* is much used in Russia, as it keeps low and bushy. It will grow here in any dry soil as perfectly as in Russia. If larger growing conifers are used they can easily be kept down by shearing. In Russia the shrubbery carayana is much used for outer rows. It is perfected hardy here, and will grow on the driest knobs. If desired to plant along our roads the seed can be imported at very low rates.

Pullman Sleeping-Car Employes.

THE Pullman company has recently framed an "iron clad contract" for its employés to sign, releasing the company from obligation to them in case of accident. It provides among other things, as follows:

"That I may be suspended, definitely or indefinitely, with or without pay, or be discharged from such employment and service at the pleasure of the Pullman company, or at the pleasure of any general, division, or assistant superintendent, or authorized agent thereof, at any time without previous notice, such notice being thereby expressly waived.

"That in consideration of such employment and service, and the payment to me of the wages or salary now or hereafter agreed upon, and as a part of the agreement for such employment and service and the payment of such wages or salary, I hereby undertake and bind myself to

assume all risks of casualties by railway travel or otherwise, incident to such employment and service, and accordingly hereby release, acquit and discharge the Pullman company from any and all claims for liability of every nature and character whatever, to me or my heirs, executors, administrators or legal representatives on account of personal injuries or otherwise."

The other clauses make it necessary for the employé to bind himself to obey the rules and regulations of the railway companies over which the Pullman cars are operated, and in consideration of free transportation if injured acquits and discharges the railway company from liability, etc.

Locomotive-Cars.

RAILWAY operating in Trans-Caspian Russia is beset with difficulties unknown to other regions where railways are used as a means of travel. A great portion of some roads are entirely waterless, there is no traffic except through traffic, and at certain seasons of the year the cold is intense, and the absence of local fuel supply renders heating and steam-making very expensive. To meet these untoward conditions, the Russian Government, which operates the railways, is having a special type of combined locomotive-car built that carries enough water to run seventy miles. From the description we have seen, we believe the locomotive-car is an enlargement of the American observation locomotive illustrated in the *National Car-Builder* of November, 1884, with modifications to suit the practice of Russian railways. There are six of these locomotive-cars under construction at Kolomna. It is expected that, owing to their lightness and compactness, they will make the desert journey quicker, cheaper, and more comfortably than the ordinary train. The exhaust-steam will be used to heat the car, and the engine will have sufficient power to pull two freight-cars, or a passenger-car, when necessary. We believe a tank-car locomotive of this description could be used to good advantage on many of our branch roads where traffic is light.

Longevity of English Engines.

ENGLISH engineers are giving no small degree of attention to the durability of their locomotives. The statistical details should be out in book form and preserved, as they will become interesting as the competition between the American and English type of engine increases. Mr. Johnson, of the Midland Railway, confines himself to breakdowns. In 1885 there were 60 cases in which an engine was rendered idle for half a day or more. Among the causes was the breakage of crank and straight axles, slide valves, and valve spindles through wear and tear; also cases of hot guide-bars, due to neglect on the part of drivers; and cases where drivers had to give up their trains. The gross engine mileage for 1885 was 43,657,427. The total number of engines, 1,803. The average mileage, supposing all the engines to have been worked, 24,200. There was one breakdown for every 727,624 miles. This includes engines of all kinds. Portions of the line are exceptionally heavy, and the trains run are the heaviest and fastest in the world.

The Carrying Capacity of Cars.

TEN years ago, remarks an exchange, a standard car load on all first-class railways was 20,000 pounds, the weight of the car being 20,500 pounds. In 1881 the load on most roads had increased to only 22,000 pounds. The master car-builders of the Pennsylvania Railroad have now adopted cars to carry 60,000 pounds, while the weight of the cars will be very little increased. Instead of hauling more than one pound of car to one pound of freight nearly three pounds of freight can now be hauled for one pound of car.

The substitution of steel for iron rails has made change possible. The condition of affairs makes it possible for the roads to carry freight at the low rates they receive, and yet make a profit.

A Caustic Soda Locomotive.

ACCORDING to the *National Car and Locomtive Builder* a company has been formed in Chicago to introduce the Honigmann fireless motor for the operating of street-railways, and for other purposes where steam-motors are objectionable, and where the work is a weariness to horse-flesh. A motor weighing about four tons was imported from Germany, and it has been tried on the Chicago City Passenger Railway Company's tracks; but it was found deficient in tractive power, and could not climb the steep approaches to the river bridges. It has now been taken to Minneapolis, and will be tried on some of the street-railways in that neighborhood.

The motor appears to possess the elements that ought to make it successful as a substitute for horses. It is noiseless in its operation, and is entirely free from steam, smoke, or dirt. Power for operating the machine during a round trip is obtained by the great capacity which caustic soda possesses for absorbing heat.

The inventor, Mr. Moritz Honigmann, is a caustic soda maker in Germany. In seeking for an economical method of reducing the dilute soda to a solid form, he introduced a closed steam coil into the sode boiler. The coil having sprung a leak, Mr. Honigmann observed that no steam was given off from the surface of the soda solution, which led him to the discovery that the latter was capable of absorbing large quantities of steam and its contained heat without giving off vapor. This suggested the idea that a body of heated caustic soda might be used, in connection with a steam-boiler, to furnish the heat required for steam making during a short trip. The Honigmann caustic soda motor is the embodiment of this idea.

The motor has an upright boiler which is surrounded by an aunular reservoir, which is filled with caustic soda highly heated. At the start, the heat of the soda mixture just keeps the steam in the boiler at the working pressure. When a start is made, the steam passing through the cylinders is exhausted into the soda-tank, where it is condensed and imparts its heat to the contents of the tank. This tending to raise the temperature of the soda, and the temperature of the boiler tending to decrease in proportion to the quantity of steam that has passed out, the magnified heat in the soda-tank passes into the steam-boiler, thus maintaining an equilibrium. After the motor settles down to regular work, the heat passes so quickly from the soda

to the boiler that the steam is maintained at an even pressure. For a short time there is more heat developed in soda reservoir and boiler than there was at the start, the increase no doubt resulting from the chemical reaction of mixing the soda with water, or its equivalent, steam. After a time the soda gets so diluted that its capacity for storing heat deteriorates, and the charge has to be removed and a fresh supply put into the reservoir. The deteriorated soda is restored in strength by evaporation of the moisture.

A Railway-Tie Nursery.

THE Hon. R. W. Phipps, Forestry Commissioner for Ontario, has been for several months devoting his time to visiting the principal fruit-tree nurseries and estates, where attention is given to arboriculture for timber and fuel. In a recent letter from southern Kansas to the Toronto *Globe*, he writes:

"One railway board here, knowing that the growing of wood, when set about in earnest, is neither a slow nor difficult task, has established in Kansas the largest artificial plantation of forest trees in North America. These railway gentlemen themselves gave out the contract for planting over a square mile of land with young saplings of the catalpa and alianthus; and their president, observing the success of their experiment, and impressed with its probable excellent financial results, has had planted at his own expense, as a speculation, as much more. These are situated near the little town of Farlington, Kan. These plantations, now bare of leaves, stretch far over the undulating prairie, in full view of the town. In summer their wide-spread surface of broad-leaved and pale green foliage forms one of the most beautiful sights of all this country. At proper intervals carriage roads are left through them, and it is a day's drive to examine them well; we obtain a carriage and horses and commence our observations. The different sections have been planted, it appears, respectively, two, four and six years ago. About one-fourth is planted with the alianthus, the rest with the catalpa, and a few, perhaps a thousand trees, of the white ash. Those first planted are now about 25 feet in height, the last about 12. Some of the taller are seven inches through the stem. The first seedings were brought from Illinois by the car-load—the rest grown in seed beds here. There are in all about 3,000,000 of trees in full growing vigor on these plantations, this calculation leaving out a few on some small portions of poor land, which are not flourishing so well, but will yet be good trees in time. All were planted four feet apart each way to shade the ground, but eight feet is the ultimate intention, which will allow three-fourths of the trees to be cut out, a thing which can well be done when they are fit for fence-posts, say 7 to 9 inches through; or, if required, they can stay even longer without injuring the plantation. When rather larger it is expected the trees will give excellent railway-ties, and at their fuller growth of fifteen or twenty years they will supply very valuable timber for cabinet work and house building. Those who have only seen the original forest, with its trees growing at hap-hazard here and there, little ones and big, have but a very vague idea of the large amount of wood the closely-planted groves can spare in their process of growth. This process, partly natural, is also by the art of the planter rendered partly mechanical. Extensive masses of young trees planted in this manner are restricted to but one method of advancement:—the endeavor to throw out masses of leaves to the light and air of the upper surface. The lower branches, hidden in shade, rapidly die and fall to the ground, and the plantation becomes a multitude of long, straight stems, full of life and vigor, but only spreading into branch and foliage at the summit. If a tree in youth be crooked it straightens itself, if thus surrounded, as it advances in height. One acre so growing will give of wood, which is all the better taken, quite a number of cords yearly till all the superfluous trees be gone. On each acre here there are 2,000 more trees planted than will ultimately be allowed to attain full growth. There will be left, perhaps, 900,000 to come to maturity, and as these as well as being very useful timber, are fast growing trees, the profits seem likely to be very large.

British Railway Earnings.

ACCORDING to the *Railroad Gazette*, the average earnings per train-mile of British railways have fallen every year but one since 1874, having been $1.36 in 1874, $1.26 in 1879, and $1.19 in 1884. But the decrease in working expenses has been almost as regular, and until 1881 just as great, so that the net earnings per train were marvelously uniform, varying only between 60.24 and 61.36 cents per train-mile from 1874 to 1880. Since 1880, however, the decrease in expenses has not kept pace with that in earnings, and the net earnings have fallen off steadily. For seven years the earnings and expenses have been, in cents per train-mile:

	1877.	1879.	1880.	1881.	1882.	1883.	1884
Receipts.....	130.50	126.24	125.42	123.48	123.80	121.76	119.12
Cost	69.38	66.00	64.74	64.56	64.94	64.34	63.19
Profit.....	61.12	60.24	60.68	58.92	58.86	57.42	55.94

The results are very much more uniform than would be shown in this country, even in those parts of it where rates are steadiest. The larger part of the reduction in expenses of the British railways has been in the cost of maintenance of road. This has fallen from 15.70 cents per train-mile in 1874 to 12.76 in 1879, and 11.64 in 1884. The decrease since 1874 has been 12.58 cents in the total expenses, and 4.06 in the maintenance; since 1879 it has been 2.82 cents in the total and 1.12 in maintenance. Meanwhile train expenses have decreased from 21.62 cents in 1874 to 16.38 in 1879, and 16.70 in 1884. Per mile of road there has been much less change. For the five years from 1874 to 1878 inclusive, they ranged from $1,865 to $2,020, for maintenance of road, and averaged $1,965. Then they fell off suddenly to $1.690, and have never been so low since, ranging thence to $1,800 in 1883 and $1,750 in 1884, and averaging $1,751 from 1879 to 1884—nearly 11 per cent. less than the average for the five years previous.

The total expenses per mile of road have been comparatively uniform, ranging from $9,665 in 1875, and $9,625 in 1883, to $8,775 in 1879, and the gross earnings have also shown less changes than might have been expected, averaging $17,690 for the five years from 1874 to 1878, in which they never fell below $17,295, nor rose above $17,755. In 1879 they fell suddenly to $16,780, but they recovered

immediately to $17,555 in 1880, and for the five years ending with 1884 averaged $17,905, reaching the maximum, $18,255, in 1883. In this country the average earnings per mile were $7,461 in 1883, and $6,663 in 1884.

Railway Relief and Pension Funds.

GOVERNOR ROBINSON, of Massachusetts, speaks of relief funds as follows, in his inaugural message, submitted to the legislature:

"The board of railroad commissioners, in their report for 1881, urged the expediency of legislation sanctioning the coöperation of railroad companies with their employés, in the formation and management of funds for the relief of men disabled by accident or disease, and for pensions to the aged and to families of those dying in their service. I am assured that the present board also cordially approves such a measure. The general benefits of such a system, in the establishment of amicable relations between the corporation and its men, in the certain improvement of the character of the service rendered, in the substantial increase of security to life and property, and in the provisions for relief in cases of suffering and hardship, are so conspicuous that argument is hardly needed in support of any practicable plan to that end. The experience of the Baltimore and Ohio Railroad Company, employing nearly 20,000 persons, has fully demonstrated during the last five years the feasibility, humanity and wisdom of such a system. Legislation will be needed to enable railroad companies to form the kind of association necessary for founding and holding relief funds, and to protect such funds from attachment by creditors."

North Island Trunk Railway.

A COMMENCEMENT is about to be made with the construction of a tunnel, which is to form part of the North Island (New Zealand) Trunk Railway. It is at a place called Porotorau, near the head of the Wanganui. Works are also being carried out at Te Kuiti, once the headquarters of Kingism. These operations are taking a number of persons into the King Country.

Fire-Proof Paint.

SILICATE of soda, mixed with whiting and tinted with ordinary dry colors, will give a paint that is fire-resisting. It is also cheap. If used for wood-work, give it two or three coats of the silicate of soda as a preparation, and for the last coat mix with whiting to get a body, and color to any desired tint or shade. In general practice the paint should be of the same consistency as ordinary paint, and is applied in exactly the same manner. Tungstate of soda is rather better than the silicate, but is more expensive.

Some Brotherhood Figures.

IT is stated that the Brotherhood of Locomotive Engineers, which was organized twelve years ago and now has a membership of 15,000, has distributed among the needy, the sick, and the injured of its flock the magnificent sum of $447,000. This is indeed a most creditable showing. The men who have done this are the present and coming locomotive engineers of this country. They are illustrations of the truth that the two qualities—bravery and benevolence—go hand in hand. No man who is a coward ever gets to be a locomotive engineer, and hence engineers and their firemen are always benevolent and brave. To such men can those who travel entrust their lives, feeling certain that no accident will happen as the result of their neglect of duty. No class of men in the world realize more thoroughly the responsibilities of their employment than do the locomotive engineers and firemen. The acknowledged truth of the above is what gives the order the strength and public respect that belongs to it. A finer body of men does not exist.

Railway Mileage.

THE following figures on the laying of tracks on new railways appear in a late issue of the *Railroad Gazette:*

Carolina Central.—Extended from Shelby, N. C., west to First Broad River, 2 miles.

Chicago, Burlington and Northern.—Track laid from La Crosse, Wis., north 10 miles; also north of Savanna, Ill., 10 miles.

Marquette, Houghton and Ontonagon.—Extended across Portage Lake to Hancock, Mich., 1 mile.

Wisconsin Central.—Track laid from the line of Cook County, Ill., north 24 miles.

This is a total of 47 miles on four lines, making in all 295 miles thus far reported for the current year. The new track reported to the corresponding date for 15 years has been:

	Miles.
1886	295
1885	165
1884	334
1883	521
1882	1,181
1881	541
1880	975
1879	298
1878	226
1877	165
1876	304
1875	129
1874	198
1873	429
1872	642

These figures include *main track only*, second tracks and sidings not being counted.

A CANAL is proposed between Philadelphia and the Atlantic, bisecting New Jersey. Congress has appropriated $30,000 towards surveying the country and preparing estimates on the total cost of the waterways.

THE Sleeping-Car Conductors' Mutual Aid Association of North America, has lately filed its articles of incorporation. The incorporators are: R. T. Cross, S. W. Rilea, E. P. Valentine, with offices at Chicago.

THE membership of the United Kingdom Railway Temperance Union inaugurated in 1882, has increased to about 10,000 employés, and the order has branches on almost every large railway.

THE Illinois Central Railroad will build a steel bridge over the Ohio river at Cairo. Its length will be 5,000 feet, with approaches about equal. It will approximate in cost $3,000,000.

MR. A. POPE has been appointed general freight agent of the Norfolk and Western Railroad, and Mr. W. B. Bevill general passenger and ticket agent,

American Railroad Journal.

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Principal Contents of this Number.

CONTRIBUTIONS.

(*Written for the American Railroad Journal.*)

EDITORIALS.

MISCELLANEOUS AND SELECTED.

STREET-RAILWAYS.

NEW INVENTIONS.

A NEW VOLUME.

THE sixtieth volume of the AMERICAN RAILROAD JOURNAL opens with the present number, and judged on the merits and success of those immediately preceding it, may fairly hope to easily maintain the high standard and reputation for general and particular excellence attained and held by its efforts to provide a valuable and reliable publication, directly relating to railways and their interests. It has been the aim of the paper since passing into the hands of the new management to win for itself a position in its field that should be second to none; and at the same time possess the special features of accuracy and reliability of news, a careful summary of all of interest that occurs in the world of track and wheels, with that attention to the details of general composition and make-up which, while affording the fullest report of all essential or desirable information, avoids any unnecessary or irrelevant matter, and effects a clear and concise monthly compendium in its special line.

In the future, as in the past, the JOURNAL will continue its policy of affording a medium open to the dissemination, discussion, and report of all that in any way relates to the great interests it represents, and will thoroughly maintain its present high standard, both literary and typographical. The various departments of the paper, which so greatly add to its usefulness and excellence, will receive the same care and attention as heretofore. The contributions on matters of special and general interest will continue to be from the pens of writers fully competent, both by education and experience, to handle their subject in an intelligent and forceful manner, while the topics of the different departments will receive that careful investigation and attention hitherto devoted to them. The street-railway will still be treated individually, and no pains spared to maintain the present excellence of that department of the JOURNAL. The pages devoted to inventors and their inventions have always received and will, as hitherto, be treated with that care and attention due a subject of first importance.

The efforts of the present management have been directed to attaining one primary result: Accuracy, truth and impartiality, with thorough and intelligent supervision over the mechanical and literary departments of the paper, evolving an entirely reliable and accurate monthly railway record.

The AMERICAN RAILROAD JOURNAL feels justified in enjoying in no small degree the consciousness of work well done, and faithful effort crowned with success, and, while believing that it can give no stronger guarantee for future worth than the assurance that its standard of the past shall in nowise deteriorate, will none the less endeavor to improve.

THE GREAT STRIKE.

MR. JAY GOULD is a man whose phenomenal financial success naturally renders him subject to frequent and severe criticism on his methods both of acquiring and managing his accumulated wealth in its many forms. Much of this censure is doubtless undeserved, and of the character dealt out to all men of great wealth, almost without exception. Just or unjust, it is a fact however that Mr. GOULD has not been popular with the public, whose sympathy has hitherto gone against him in the contests between himself and those in his employ; but in the present quarrel the situation is reversed. Throughout the strike on his and the connecting lines in the west and southwest, Mr. GOULD'S line of action has been temperate and forbearing, and to impartial judges, it would appear that he has done all consistent with his official and personal dignity to place matters on a mutually satisfactory footing. Certain it is that in this last and greatest contest between capital and labor, Mr. GOULD has public opinion on his side.

To properly estimate the rights and wrongs of the contest it is necessary to trace its progress from its inception, and to consider its cause. As is widely known, this latter lay in the discharge of a workman in the employ of the Wabash road in Texas, by authority and under the direction of the United States Court, as represented by its receiver. Granting a refusal to reinstate this man by the road to be a fair and just reason for a strike thereon, the mileage represented by the interested parties was but a small fraction of the enormous aggregate of line whose interest and business, and still more important, public obligations were for a time paralyzed and rendered null. Towns, communities, sections, and counties were deprived of their regular and looked-for supply of necessities, with the obvious result of so raising prices therefor in proportion to their scarcity, as to put all classes to an enormous aggregate expense, and individual trouble and inconvenience. And why? Simply because the workmen belonging to the order known as the Kights of Labor of a single road, failing to enforce their demand for reinstatement of a discharged employé, used the machinery, or their organization to force the men of outside lines to work with them.

These had no connection, however remotely with the question, or the authorities responsible for the discharge. There was no complaint of ill-treatment, or unsatisfactory wages. On the contrary, when the manager of the Missouri Pacific, surprised by the strike, asked of Mr. POWDERLY the reasons assigned, he, the head and front of the Knights of Labor replied, "papers say strike caused by discharge of man named Hall," and asks for a reinstatement of this Hall, pending investigation. It would seem to the intelligent observer that the time for the investigation would have been before striking.

An agreement was entered into last spring between the railway managers and those of the labor order that, no strike should be made before holding an investigation on the point in dispute; yet these men struck in defiance of that distinct understanding, and, moreover after striking, admitted that they had no cause for difference with the roads in whose employ they then were, but simply and solely to support a demand of workmen on a totally distinct and separate line; a demand which neither Mr. GOULD nor his associates had the slightest power either to comply with or refuse. They hoped, however, by causing great distress to the public, and loss to the connecting lines, to enforce the claim utterly irrespective of the question of right or justice.

Let it be granted, however, that in all this they still kept within the law line, and were legally justified therein; for however unreasonable and tyrannical the attempted exercise of fancied power, we will admit the abstract right of using such strength as striking, whether justified or or not, gives them. Had the labor order stopped there, while public opinion would still have been against them, they could have truly responded to criticism and complaint, "it is our right." But this they did not.

The crimes of wanton blood-shed and destruction are chargeable to their violence, and in order to protect life and property, and to ensure their rights as citizens to those others who, needing work, gladly pick up what the strikers have cast away, it became necessary to call out an armed force, that men willing to work, should be afforded opportunnity to peacefully earn their daily bread. When this last resource is called on, it can only be the outcome of the strikers' wrong-doing and disorder, for so long as the line of law is not overstepped there can, in the nature of things, be no necessity of invoking military aid. It is only when the Knights of Labor say that what they do not want none shall have, be the price blood or treasure, that force is necessary to cope with the their defiance of of law and order.

There is fortunately no unmixed evil. When this extremity is reached it forshadows the disintegration and defeat of the responsible party: for the voice and opinion of the great public is then heard and expressed, and without this strongest of allies all causes fail. So is it with the present strike.

Primarily and instinctively, the people sympathize with the workingman, and quick to give labor the benefit of doubt, will suffer much before withdrawing its countenance and support. But when doubt ceases, and the certainty of a great wrong and oppression takes its place, the people's voice is heard in tones that permit no plea of deafness, and which utterly overwhelms and

drowns the noise and clamor of the party in the wrong.

With a steady and consistent course on the part of the railway managers, and the lines hitherto followed the strike is doomed to failure; and although the loss of life and property is much to be deplored, there is the compensating and satisfactory reflection that, while so vigilantly guarding against the stealthy approach of the dreaded king "Monopoly," we have escaped the serfdom of a far more dangerous ruler—the tyrant Labor.

EDITORIAL NOTES.

CHANCELLOR RUNYON, of New Jersey, has recently handed down a decision on a point in dispute concerning the New Jersey Central Railroad. Judge LATHROP, the former receiver of the road, made contracts with parties for the delivery of certain supplies required by the road. Before the final settlement of this agreement Receiver LATHROP died, and was succeeded by Receiver LITTLE. In the meantime the supplies are delivered, and payment demanded of Mr. LITTLE. He, for some reason, possibly a good one, does not desire the supplies, and refuses payment, or any responsibility for the acts of his predecessor, and Chancellor RUNYON'S opinion supports his position. If this be a sound judgment, and is generally so understood, it would seem not impossible that receivers thereafter might find some difficulty in transacting very necessary business. It may be good law, but it is poor justice.

* * *

THE Brotherhood of Locomotive Engineers has hitherto kept clear of any entangling alliance in the present strikes. A finer body of men never gave their daily toil for bread. They have courage, brains, and power, but an instance of the latter arbitrarily exerted is yet to be adduced. If the Brotherhood were but a type of labor generally, strikes would be unknown.

* * *

WHATEVER may be said for or against the establishment of a national railway bureau, one consideration of great consequence is at once presented to the mind. The members of such a commission would of necessity be subjected to an influence and power far in excess of that representing any other one special interest of the country. Experience has shown that this influence would be by no means idle or inactive, where appear results so promising as those to be attained by a successful attack on the integrity of a public body, invested with a power which wielded in the strict interest of the people would make so vast a difference in the relations of that great body and the corporations which would be affected by its official action. The point is worthy of careful consideration.

THE boycott as a weapon of the labor organizations seems rapidly to lose its edge. At all events the latter is transferred from blade to hilt; and in the warfare waging, it will need an iron grip to keep the sword from slipping in the wielder's grasp, and drawing blood. That labor has the instinctive sympathy of the people is undeniably true; but when a point is reached where the oppressed become oppressors, that first of friends and allies—public opinion—joins issue with the enemy, and labor must surrender. The famous bakery of Hudson street, and Mrs. Gray, its plucky owner, fully illustrate the truth that tyranny attempted in the guise of justice is doomed to failure; and, further, will recoil upon the tyrants.

* * *

DR. S. S. HERRICK, the author of the admirable series of articles on "Railway Medical Service," which have appeared at intervals in the JOURNAL for several years past, has severed his connection with the State Board of Health of Louisiana, of which he has been secretary for many years. Dr. HERRICK has devoted years of study to the subject of railway medical service; first in its sanitary and afterwards in its practical aspect, and, as we said last month, in knowledge of the subject he stands unsurpassed. His studies have given him unusual opportunities to become qualified for organizing and superintending a medical department upon a leading railway of the country, and we are pleased to hear that he is prepared to entertain a proposition of this nature. It would seem likely that some road will hasten to secure his services in such capacity.

WE have received from the *Railway Master Mechanic* the Official Railway List for 1886. Higher praise can not be given than to say that it in all respects maintains the standard of the issues of previous years. It forms a most valuable cyclopædia of general information of much interest and use to the laity as well as to the profession. It is a complete and accurate index of all the officers, superintendents, managers, agents, and office-holders generally connected with the various railways of the country; and the vast amount of valuable information it contains is skilfully classified, and provided with an admirable index which renders reference easy. It is a work which no one whose interests, however remotely, relates to railways should be lacking.

THE April *Century*, completing the thirty-first volume, or the ninth volume of the new series, is an exceptionally interesting number. The war series is continued by three valuable, illustrated papers on the famous confederate cruiser, *Alabama*. "Life on the *Alabama*," by P. D. Haywood, one of the crew; "Cruise and Combats of the *Alabama*," by Capt. John McIntosh Kell, her executive officer, and "The Duel Between the *Alabama* and the *Kearsage*," by Dr. John M. Browne, surgeon of the latter vessel. "Creole Slave Songs," by George W. Cable, with musical arrangements, and "Toy Dogs," by James Watson, are among the remaining illustrated contributions to the number.

Street-Railways.

American Street-Railway Association.

President.—Julius S. Walsh, President Citizens' Railway Company, St. Louis, Mo.

First Vice-President.—William White, President Dry Dock, East Broadway and Battery Railroad Company, New York City.

Second Vice-President.—C. B. Holmes, President Chicago City Railway Company, Chicago, Ill.

Third Vice-President.—Samuel Little, Treasurer Highland Street-Railway Company, Boston, Mass.

Secretary and Treasurer.—William J. Richardson, Secretary Atlantic Avenue Railroad Company, Brooklyn, N. Y.

Office of the Association, cor. Atlantic and Third Avenues, Brooklyn, N.Y.

The Fifth Annual Convention of the Association will meet in Cincinnati, O., on Wednesday, October 20th, 1886.

HONESTY AS POLICY.

THE Broadway Street-Railway franchise seems in a fair way to be repealed, and the coveted result of a long and laborious course of dishonesty and corruption to end in bitter disappointment to the chief conspirators.

The Aldermanic Board of 1884 must have been rudely awakened to a belief that there is a God in Israel, and by this time, in all human probability, sadly and severally admits the force of the old saw naturally suggested by our heading.

There can be no doubt in the least intelligent mind that bribery and fraud were the prime factors of the Broadway railway steal. It is unfortunately possible that, as so often before, the principals may go unpunished, for lack of evidence to convict, but the public is none the less convinced of their guilt, and will not easily forget the names of those implicated.

The public is an amazingly patient and long-suffering beast of burden, and submits to an almost limitless amount of misgovernment and fraud; but there exists the proverbial straw which brings about the spinal (and final) fracture. When this point is reached the people call a halt; and the order is one requiring prompt obedience, failing which the results are apt to be somewhat disastrous. From all indications the Broadway outrage seems to mark a line beyond the limit set for steals, the crossing which has roused a determination that the time has come to demonstrate that there is not, as seems generally to be believed, a law for one class only; to which the lawmakers cannot be held accountable.

Judged from its lowest stand-point, in this instance at least, honesty would have been policy. Broadway needed the railway, as results have plainly shown; and the opposition to the scheme arose not so much from any objection to the presence of the road, as antagonism to JACOB SHARP, and the methods which everyone felt certain he would use to gain his end. The foregone and subsequently justified conclusion of the public, that no means, however, dishonest would be spared to gain the good will of a body of men notoriously corrupt, naturally resulted in identifying the road with the rascals, and brought down upon it the hearty denunciation and opposition of the public; and unless the people's resentment cools much sooner than seems likely, an ample opportunity for meditation and a change of heart will be afforded by a generous State government to the City Fathers of 1884.

Can we but venture to believe that the lesson will suffice forever to rid our city of its domination by the gangs of political brigands who fatten on our wrongs, the cloud is lined throughout with silver, and the purchase is worth the price.

TWELVE hours seems now the generally accepted limit for a day's work on the horse-railways, and the result so far appears to give general satisfaction. It is not probable that any man can work to advantage more than one-half of his entire time, and if this be true, the question of hours is one entirely removed from that of wages, for whatever they might be, high or low, a day's work of more than twelve hours must be a bad investment.

STREET-RAILWAYS ON THE CONTINENT.

BY MARVIN C. WILLIAMS.

[Written for the AMERICAN RAILROAD JOURNAL.]

THE street-railway service as managed on the continent of Europe would doubtless commend itself more favorably to the average traveler than either that of Great Britain or our own country. It must be admitted that in certain features and regulations appertaining to the continental service, the advantage lies on that side of the water.

It is not that the roads are better laid, manned, or equipped, or that transfer thereon is in any way more expeditious, for in these points the several countries mentioned are not far from being even.

To that widely known and popular character, the "casual observer," the feature of continental tramway travel which chiefly claims his admiration and approval is the entire absence of crowding in the cars; the law prohibiting the carrying of any number of passengers in a car exceeding that of the seats. In addition to this regulation, in favor of which much can be said, another distinctive custom common to nearly all countries of Europe, is the carrying of passengers on the car-roofs. This latter would certainly seem, where practicable, a plan in all respects advantageous, as it provides a first and second class rate of fare, gives a larger seating capacity, and combines the advantages of both our summer and winter cars. As to the effect of two rates of fare on a company's receipts, the point would demand a thorough trial of both methods under precisely equal conditions, and a careful comparison of results. That, however, is a question which does not so directly affect the comfort of travelers, as the mere personal one of accommodation.

It must without doubt be granted that much is to be said in favor of a law compelling all tramway companies to provide a seat for every passenger, but it should be

remembered that while such a law ensures a seat to each passenger in the car in which he is conveyed, it will at times follow that he will be without the means of conveyance at all, for at best the law can but prohibit a company from carrying in a car more passengers than it has seats. At such a time a would-be patron of the road is rather apt to resent his legal disability to stand up if he so wishes, and arrives at the conclusion that the law approximates too closely the paternal. It is true that the double-deck character of the street-car of Europe to a great extent obviates this objection, that is to say, proportionably; but it is by no means an unusual circumstance in Paris or Turin, to be compelled to wait while half a dozen cars pass before one is found with the sign "full" turned down. It is also probable that even with the use of the roof, the continental car, divided as it is into separate seat spaces, would fall short by a considerable number of the capacity of a crowded American car, with the customary platform attachments.

The introduction of the roof system into the cities on this side would, however, be a considerable gain in comfort and convenience. New York unfortunately is past the point of that improvement, as the slight elevation of many portions of the elevated roads would render it impossible.

As to the lauded virtue of the no-seat-no-ride plan, it would perhaps at least be worth the trial, could it be shown that the companies would increase their accommodation to an equal carrying capacity. Even then it is probable that the main result would be that those who now do not ride from sheer inability to incorporate their persons into a solid mass of motionless humanity, would then perceive a revised and enlarged opportunity for enjoying erect transportation, of which they would promptly take advantage; for it may be fairly doubted if any free and enlightened American citizen would tamely submit to forcible deprivation of his cherished right and privilege to be uncomfortable.

PROGRESS OF ELECTRICITY AS A MOTIVE-POWER.

[Report of the Special Committee read at the recent Convention of the American Street-Railway Association.]

YOURSELF, Mr. President, in words glowing with eloquence, stated at our last Convention, how little we know of the wonderful force called electricity. "Electricity" was derived from the Greek word *elektron* expressive of amber. Thales of Miletus, a celebrated Greek philosopher, 600 years before Christ, having observed the remarkable property of amber by which it attracted light particles of matter upon being subjected to a peculiar kind of excitation by friction, called this force electron. Nearly 2,500 years have since elapsed, and we still only know this wonderful force by its effects. Electricity has been defined by Grove as "that affection of matter or mode of force which most distinctly and beautifully relates other modes of force and exhibits, to a great extent in a quantitative form, its own relation with them and their reciprocal relations with it and with each other." Wells wrote, "Electricity is a subtile agency or force without weight or form, that appears to be diffused through all nature existing in all substances, without affecting their volume or temperature, or giving any indication of its presence, when in a latent or ordinary state. When, however, it is liberated from this repose it is capable of producing the most sudden and destructive effects, or of exerting powerful influences by a quiet and long continued action."

Tyndal wrote, "We have every reason to conclude that heat and electricity are both modes of motion; we know experimentally that from electricity we can get heat and from heat, as in the case of our thermo-electric pile, we can get electricity. But, although we have, or think we have, tolerably clear ideas of the character of the motion of heat, our ideas are very unclear as to the precise nature of the change which this motion must undergo in order to appear as electricity—in fact, we know, as yet, nothing about it."

Gordon wrote, "We have as yet no conception of electricity, apart from the electrified body; we have no experience of its independent existence." * * He estimates that "The velocities in air of light and of electro-magnetic induction are sensibly equal—185,521 miles per second."

Wheatstone, in 1834, by a beautiful experiment, showed that the velocity of an electrical discharge through a copper wire a half mile in length was 288,000 miles per second. The results obtained by the United States Coast Survey, with galvanic electricity and iron wire, show a velocity of from 15,000 to 20,000 miles per second. Your committee will not occupy your valuable time in enlarging upon the wonderful discoveries that have resulted from the investigations of Farraday, Cavendish, Franklin, etc., etc., but will proceed to speak of the application of this force.

One of the oldest electric motors was that of the Abbé Salvatore del Negro, Professor of Natural Philosophy at Padua. A dynamo machine made by him and recently exhibited, bears the date 1830. It consisted of a magnet movable around an axis, situated at about one-third of its length, the upper extremity of which was capable of oscillating between the two branches of an electro-magnet. A current being sent into the electro-magnet, passed through an 8 cupped mercurial commutator that the oscillating magnet controlled by means of a rod and a fork. As a result of such an arrangement, when the magnet had been attracted toward one of the poles of the electro, this very motion of attraction, acting upon the commutator, changed the character of the current, and the magnet was repelled toward the other branch of the electro, and so on. This apparatus possessed an interesting detail. The movable magnet, where it touched the poles of the electro, abutted, not against the iron itself, but against the insulating wire that covered it. Either by accident or design, the author thus avoided those inconveniences connected with remanant magnetism, which afterwards embarrassed other inventors.

March 1st, 1834, an English patent was taken out by Henry Pinkus, for a "dynamic-traveler," intended to propel vessels and carriages on canals, railways, and common roads, by means of magnets and electricity, as well as pneumatic power.

In 1838 Mr. Cook, of Saratoga, N. Y., made an interesting exhibition of an electro-magnetic machine, in Barclay street, New York. In 1838 and 1839 Prof. Jacobi, by

means of an engine on the same principle, propelled a vessel, containing ten persons, along the Neva, at the rate of four miles per hour.

In 1841, "The Germanic Confederation, desiring to acquire, for the purpose of publishing for the public good, the secret by which citizen Philip Wagner, of Frankfort, makes use of electro-magnetism as a moving force, will secure to the said Wagner, for the exclusive possession of his secret, the sum of 100,000 florins ($55,000), on condition that he cause an electro-magnetic machine to be constructed at his own expense, and upon a sufficiently large scale to serve as a locomotive." We do not find that Wagner accepted this proposition.

In 1841 Robert Davidson, a mechanic of Aberdeen, exhibited working models of a turning lathe, printing machine, saw-mill, and locomotive carriage, driven by the power of electro-magnetism. In October, 1842, his electric locomotive carriage was tried upon the Edinburgh and Glasgow Railway. It was 16 ft. long, 6 ft. wide, and weighed about 5 tons. Speed about four miles per hour. Time will not permit a description of Joule's electro-magnetic engine, Davenport's, Lockey's, Clarke's, Wright's, Taylor's, Watkins's, etc., etc. In 1840, Prof. Page, of Salem, Mass., invented a new form of electric engine, based upon the principal of the axial force of electro-magnetism, which proved very successful, and Congress appropriated $30,000 to construct and operate such a locomotive. It was built in 1851, and used to propel a train between Washington and Bladensburg, five miles. It weighed, with batteries, 10½ tons, and carried seven passengers at the rate of nineteen miles per hour.

We must not omit to mention that in 1833, Prof. Henry, of the Smithsonian Institute, invented the first motor for producing rotary motion by electro-magnetism, without a reciprocating action.

The first machine for the production of a current constant in direction and intensity, is said to have been the electro-magnetic ring machine of Dr. Pashinatti, of Pisa, Italy, in 1860. "Wilde, in England, constructed a machine in 1866, involving several new principles, and possessing a power before undreamed of. It is the type and original of many of the best machines now in use." (Younge).

In 1869 M. Griel, a French military officer, invented an electric motive engine, based on the action of currents on currents. He stated that he could apply his machine to railroads, and, by causing the electricity to wash from the wheels of the machine upon the rails, ascend any grade with the greatest facility. In 1872 the Gentry Electric Railway Car was exhibited at Nashville, Tenn. This engine was composed of a number of magnets. The armature was made to work by breaking and closing the circuit. It was proposed to build an elevated railroad upon poles set in the curbstone and carry mails and light packages at a *speed of one hundred miles per hour!*

The efforts, so far, of inventors were directed to the application of electricity generated by the action of acid upon zinc. Prof. Morton wrote, "The source of energy in the battery is practically the zinc consumed; weight for weight coal has almost six times the available energy of zinc; while, moreover, the price of zinc is about twenty-five times that of coal. In the race between the two, therefore, zinc starts with this enormous disadvantage, that an equal amount of energy obtained from it, will cost about 150 times as much as if obtained from coal." According to Joule, the consumption of a grain of zinc, though 40 times more costly than a grain of coal, produces only about one-eighth of the same mechanical effect. The power obtained in this way was too expensive to compete with steam. Dr. Adams wrote upon this subject: "You ask, I imagine, what has rendered possible at this day (1884), that which was thirty years back demonstrated impracticable; and in what respect does the *modern* electric railway differ from that of the past? My answer is: That which has rendered the electric railway commercially feasible, is the discovery by Messrs. Varley, Siemens, and Wheatstone, and the subsequent developments by many others, of the dynamo-electric machine; and the further discovery or demonstration by MM. Fontaine and Gramme, of the reversibility of that machine, which admits of its being transformed into the most efficient form of an electric motor, when a suitable electric current is passed through it. The *difference* between the ancient and the modern electric railway consists in the fact that, whereas the effort was formerly made to use electricity as a *primary* motive power originating from the consumption of zinc and acid, we now use the electric engine or electro-dynamic machine, as a *secondary* motor, and the electric current simply as a means of transmitting power procured from natural sources, or previously generated by any of the known economic methods."

Greer states—"When the late lamented Clerk Maxwell was asked by a distinguished scientist what was the greatest scientific discovery of the last quarter of a century, his reply was, 'That the Gramme machine is reversible.' If he were alive to-day, he would probably say that the storage of electricity was the greatest invention or discovery of the last quarter of a century." Gramme first described his continuous-current machine in 1871, and his alternating machine in 1878. If an electric current be sent through the wires of a Gramme machine, the armature will revolve, and the machine can be employed to do mechanical work. By means of two such machines, one driven by water or steam power to generate electricity, the electric currents produced can be carried through insulated wires to the second machine, at a greater or less distance, which they will cause to revolve and do mechanical work.

We now reach the first practical electric railway. In 1879 Dr. Werner Siemens introduced his electric railway at the Berlin Industrial Exhibition, with an isolated center rail. During the summer of 1880 it worked at the Brussels Exhibition, and May 16th, 1881, the first electric railway was opened for passenger traffic at Berlin, by Messrs. Siemens and Halske. It was about 1½ miles long. Gauge, 1 meter (3 ft.). Permanent way was constructed as upon ordinary railways, on cross ties, with steel rails connected by fish-plates and short straps of iron, bent in the form of a bridge, to allow contraction and expansion of the rails, and reduce electrical resistance. Currents were low tension, and no difficulty was experienced in using the one rail as positive, the other as negative, conductor. A steam-engine ran the dynamo, and the current was carried from it to the rail underground. The car was similar to ordinary tram-cars, seating twenty persons. Each end was provided with starting levers, brake-handle, and signal-bell. The dynamo machine

under the car transmitted its movements to the wheels by spiral steel springs. The wheel-tires are insulated from the axles, and run in electrical connection with brass rings, fastened on the axles, but insulated from them. Contact brushes were pressed against these brass rings, and from them the current was conducted to the dynamo machine, setting it in motion. Greatest speed allowed, 124 English miles per hour. In 1882 a second car was placed on the line, when it was found that the two cars moved in either direction as safely and with the same speed as a single car, but the steam-engine that provided the electric current, had to exert twice the power. On the tramway from Charlottenties to the Spandauer Berg, in the western outskirts of Berlin, Dr. Siemens overcame a rising grade of one in thirty. The line, constructed as an ordinary tramway, is distinguished by two thin wire cables, about 9 inches apart, and carried on telegraph poles, about 15 feet high. These cables are parallel to the track, and upon them runs a small 8-wheeled carriage. A wire extending from this to the tramway-car dynamo, conveys the electricity to the latter. This was the form adopted at the Paris Exhibition, but it was said that not a little difficulty was experienced from this carriage getting off the wires. This plan was likewise adopted for the Siemens' Electric Railway at the collieries of the Donnersmarckhütte Co., in Silesia. Speed on latter, 8 miles per hour. In October, 1881, work was begun on an electric railway between Portrush and Brush Mills, in Ireland, by Sir W. Siemens. Capital stock, about $225,000. The line, about 6 miles long, is worked by electricity generated by turbine water wheels. Gauge, 3 feet. One-half mile is in a street in Portrush, balance in a country road. Rails are laid on one side of the road, and ordinary traffic cut off by raised curbstones. It has grades of 1 to 35, and occupies a space 6 feet wide in the street. An underground cable carries the electricity to a "T" iron, supported on posts 10 feet apart. It is 22 inches from the inside of track-rail, and 17 inches above the ground, to some extent forming a fence. From this "T" iron the electricity reaches the motor, through two brushes, one at each end of the motor, pressed against the "T" iron by springs. At each road-crossing this "T" iron is necessarily left out, and the current is carried across by buried insulated copper wires. The car is long enough to reach across most of these openings, so that one brush touches. In dry weather this rail has to be lubricated, but in wet weather the dampness suffices. From the brushes the current passes to commutator, worked by a lever, thence through the axle-boxes to the axles, through the wheels to the rails. The latter are insulated and carry the return current back to the generating maching. Speed, 10 miles per hour. In 1883 the electric railway at Wimbledon was in operation. Speed, 6 miles per hour with nineteen passengers, over rough track. The current was generated from a Weston dynamo, and driven by a twelve h. p. engine, and carried by two flat copper bands, an inch broad, laid in the bottom of a groove in long wooden troughs between the rails, supported on wooden blocks saturated with pitch. The insulation was quite perfect.

The electro-motor invented by Leo Daft, was given a trial Nov. 24, 1883, on the Saratoga, Mt. McGregor and Lake George Railway. The small motor hauled a passenger car well filled, over a mile and a half of road; but on the return trip jumped the track at a sharp curve and was wrecked. Gauge, 3 feet. Track prepared for motor by tightening fish plates and laying a center insulated rail upon wooden blocks, saturated with pitch. Surmounted a sharp curve and 9.3 feet grade. The motor weighed 4,500 pounds, was 9 feet 6 inches long, 5 feet wide, and 3 feet above rail, provided with necessary levers, etc. Two phosphor bronze wheels, pressed firmly upon the center-rail by steel springs, carried the electricity to the switches and key-boards, thence to the electric-engine and through the driving-wheels to the outer rails. It is claimed that experiments proved the electricity increased the adhesion 20 per cent., a most important feature. The motor took 17 tons of car and passengers, and it was said no difficulty was experienced from snow and ice.

Thomas A. Edison built an experimental line at Menlo Park. The motor contained a dynamo, but appeared like a small locomotive without a smoke-stack. A speed of 40 miles per hour is said to have been obtained. Stephen D. Field spent years in perfecting his system of electric motors, and the Electric Railway, at the Chicago Exposition of Railway Appliances, was a combination of the Field and Edison systems. The electricity was communicated from a stationary dynamo to the motor by an extra insulated rail (in the center of the track), through brushes bearing upon each side of the latter.

Dr. W. Adams exhibited a working model of an Electric Railway in St. Louis, in April, 1884. He stated, "This idea of the generation by dynamo-electric machines of powerful currents of electricity at stationary points, and the transmission of these electric currents to cars while in motion, for the purpose of effecting their propulsion, was first put into execution in 1879, by Dr. W. Siemens and myself, both working independently and mutually, ignorant of the other's doings." Dr. Adams proposed to "apply the electric power directly to every wheel, to the point of traction where the power is absorbed, the work done, and yet our wheel is neither an 'armature' nor a 'field' of a dynamo. It is both combined. * * * Each wheel is animated, having a power within itself. Hence every wheel becomes a veritable locomotive."

W. M. Thomas, of Cincinnati, in his patents, proposed to carry an electric current through two insulated copper wires placed in an iron tube in the horse paths, making this tube open top and bottom, the former to allow contact between the motor and the conductors, and the latter to permit water and dirt to drop through into a tunnel beneath, thus keeping the conductors clean.

(*To be concluded.*)

French Method of Treating Steel.

FURTHER tests of the new French treatment of steel for rendering it tough appear to confirm its value, imparting to it also a fineness of grain, an increased hardness, and a notable accession of strength to withstand rupture; this effect being most marked in the case of highly carbonated steel, and in this respect the metal is made to resemble tempered steel, without being in all points identical with it. The cause of this alteration in physical condition is attributed to the rapid heating and no less rapid cooling of the metal; that is, when the red-hot

steel is first strongly compressed, which is the peculiar feature of this process, the conversion of the mechanical energy into heat serves to raise the temperature of the entire mass, at the same time that the particles of the metal are more closely cemented together; this effect is followed by a rapid cooling, due to the contact of the plates of the hydraulic press with the surfaces of the metal, and the very close pressure materially increases this conducting effect of the cold metal.

STREET-RAILWAY NEWS.

ALABAMA.

THE Anniston Street-Railway Company has been incorporated by A. L. Tyler, S. Noble, J. W. and Wm. Noble. Capital, 20,000.

The Birmingham and Pratt Mines Street-Railway Company has been incorporated by J. A. Van Hoose, J. R. Smith, and others. Capital stock, $100,000. The right-of-way has been granted and stock subscription books opened.

The Mobile City Railway Company has elected officers as follows: President, A. A. Spiro; Secretary, John Maguire; Treasurer, Meyer L. Goldsmith; Superintendent, W. Frolickstein.

COLORADO.

The Denver Street-Railway Company has brought suit against the Denver Electric Railway Company to prevent it from operating its line by other motive-power than electricity. The latter company is enjoined from using horses, and as the electric-cars are a failure, it is trying to evade the agreement by using mules.

The Trinidad Street-Railroad was recently sold at auction. There were only two offers, of $3,000 each, both of which were refused. A citizens' syndicate has now guaranteed its purchase.

CONNECTICUT.

The senate has authorized the incorporation of the Meriden Horse-Railroad Company, capital, 15,000, with power to increase to $200,000.

DAKOTA.

Rapid City will have a street-car line this spring. Piene has now the only line in the territory.

DISTRICT OF COLUMBIA.

A car of the Metropolitan Line, Washington, was run into on February 27th by an engine at the crossing of Virginia avenue and the Baltimore and Potomac Railroad. The car was nearly demolished and the passengers badly shaken up, but not seriously injured.

The Union Passenger Railway Company has been incorporated to build a line in Washington. Capital, $100,000. Incorporators: E. N. Gray, W. F. Sadler, and others.

The Washington City and Bladensburg Railroad Company and Land Association has been incorporated to build an electric railway from Washington to Bladensburg. Md., and to deal in land. Organized at Bladensburg by James N. Tinker, W. H. Frear, and others.

GEORGIA.

The Metropolitan Street-Railway Company, Atlanta, will extend its line to Grant park and build new stables.

The Habersham street-car line, Savannah, will shortly be extended to the new southern limits of the city by the Coast Line Railroad.

The Rome Street-Railway will be extended two miles to a new park.

ILLINOIS.

The Aurora Street-Railway is proposed to be extended through a thickly settled portion of the city.

The Chicago City Railway Company will extend its Hyde Park dummy line to Sixty-ninth street.

The Davenport and Rock Island Street-Railway Company has been incorporated to build a line across the Mississippi between these places. Capital, $30,000. Morris Rosenfeld, H. G. Connelly, Henry Curtis.

The Freeport Common Council have granted a franchise for a three-mile line to H. J. Northrop, vice-president and manager, New York Construction and Improvement Company.

The North Chicago Street-Railway has been sold to a Philadelphia syndicate for $1,750,000. Mr. C. T. Yerkes has been elected president.

Sterling is to have a street-railway.

The Streator Surface Street-Railway Company has been incorporated by H. A. Foster, Daniel Hienan, and others. Capital, $50,000.

The Union Elevated Railway Company, Chicago, has been incorporated by Michael Ryan, county clerk, P. A. Hoynes, United States commissioner, and others. Capital, $10,000,000.

KENTUCKY.

A new motor for street-cars has been brought out by Mr. W. P. Emerson, of Frankfort. It is operated by levers in the manner of a hand-car, but it is so proportioned that it is claimed a loaded car can be driven with little more exertion than driving a sewing machine.

The Frankfort Street-Railway Company has been incorporated.

The Frankfort, Bellepoint and Leetown Street-Railway Company is to be incorporated.

Louisville has 111 miles of street-railway—single-track.

MASSACHUSETTS.

The Acushnet Street-Railway Company, of New Bedford, has been authorized to operate by electricity. The Massachusetts Electric Power Company, Boston, has the contract for Daft motors.

The Brockton Street-Railway Company now pays its drivers and conductors by the week, which results in an advance of wages.

The Fall River Board of Aldermen have granted a location to another street-railway company organized by Mr. Geo. H. Seeley, of New York, principal owner of the Worcester street-railway. It will be a rival of the Globe Railway Company. The entire location asked for was granted on the condition that the whole route be paved with granite blocks, and that bonds be given for the completion of the road in six months.

The Gloucester has awarded contracts for 230 tons of steel-rails (160 tons to the Johnson Rail Company, and 70 to the Cambria Iron Company, for T-rails); 5,500 ties, Chas. H. Brigham, Hudson; 20,000 tons of cobble stones, 100,000 paving blocks. Cars are being built at the Jones Works, Troy, N. Y. Line to be ready by May 2d.

The Haverhill and Groveland Street-Railway will be extended through the Highlands and also to West Newburg during the spring.

The Springfield Street-Railway Company has given a contract for 75 tons of steel rails to the Worcester Steel Company.

MICHIGAN.

Mr. M. W. Greenwood, of the Fort Wayne and Elmwood line, thinks Detroit street-railways will soon have some other motive-power than horses. He favors electricity, with third-rail as preferable to the overhead wires.

The Grand Rapids cable road will be commenced soon.

The Windsor Electric Railway Company have been authorized to lay track through the street.

MINNESOTA.

A Minneapolis Cable Railway Company has been organized.

A motor line is to be built from Anoka to Champlain. The incorporators are: J. E. Osborne, Chas. M. Loring, W. S. King, and others.

The Lyndale motor line will experiment with the Honigman soda motor.

The Minneapolis and Champlain Railroad Company has been incorporated. Capital stock, $500,000. President, Geo. Brackett; Secretary, G. W. Marchant.

MISSISSIPPI.

The Hill City Street-Railway Company is to be incorporated.

MISSOURI.

The elevated railway to connect Kansas City, Mo., with Kansas City, Kan., has been enjoined from proceeding with the work.

The Northern Central Street-Railroad Company, St. Louis, has opened its line, and has received 40 cars from the John Stephenson Company, and others from local builders. It is the fifteenth street-railway in the city.

NEW JERSEY.

The Guernsey Improvement Company has cancelled its contracts for improvements at Cape May. They included a railway from the steamboat landing to Sea Breeze, and another thence to Sewell's Point. The Cape May citizens are hostile to non-resident property owners.

A horse railway is proposed in Asbury park and Ocean Grove.

NEW YORK.

The Binghampton cable road dispenses with the grip. A small cable driven by the main cable passes over a drum attached to the car. When the drum is free to revolve the cable simply turns it, when it is stopped by a brake the car is carrried on with the cable.

The Brooklyn City Railroad Company has leased the line on Jamaica road, between East New York and Cypress Hills, for $65,000 for 99 years. The same company will also erect a large hotel at Fort Hamilton.

The Fishkill and Matteawan Street-Railroad Company has been incorporated by John Kingsley, Sandy Hill; Charles D. Haines, Brooklyn, and others. Length two miles. Capital, $25,000.

The Greenbush Street-Railway is laying track on Riverside avenue and Broadway.

The Lutheran and Cypress Hills Railway Company (Brooklyn) had its depot burned February 26th. The depot, sheds, and stables were burned, with forty cars, seven motors, and a quantity of harness. The horses were saved with difficulty. Loss over $100.000. Partly covered by insurance.

The representatives of the New York street-railway companies have formed a union so that they may all act together in the event of any future strike.

The senate has passed a bill providing that street-railway franchises shall be sold to the bidder who will undertake to carry passengers at the lowest rate.

The Seneca Falls and Waterloo Street-Railway has received another steam-motor from H. K. Porter & Co., Pittsburgh.

The Syracuse and Onondaga Railway Company proposes a belt line.

PENNSYLVANIA.

A street-railway is proposed for Apollo. Mr. W. J. Guthrie is interested.

The Pittsburgh, Allegheny and Herr's Island Street-Railway Company is the applicant for the right-of-way.

The Pittsburgh, Knoxville and St. Clair Street-Railroad Company has been incorporated by Thomas Evans, Pittsburgh; J. E. Duncan, Chartiers; J. W. Patterson, Knoxville. Capital stock, $60,000.

The Philadelphia street-railways have a total authorized capital of $32,766,200, of which $10,408,102 90 is paid up. The aggregate cost of lines and equipments is $5,903,-920.76. Last year there were 117,171,621 passengers, and the total dividends were $991,990.

RHODE ISLAND.

The Pawtucket Street-Railroad Company has decided to make considerable extensions to its lines.

SOUTH CAROLINA.

The Enterprise Railroad Company, of Charleston, has completed and opened for traffic its new line to the Ashley bridge, across which it is intended to extend the line ultimately. There are six new cars from the J. G. Brill Company, Philadelphia. Thirty new horses have been added to the stock.

TENNESSEE.

The Chattanooga Street-Car Company will shortly commence work on its double-track.

TEXAS.

The El Paso City Street-Railway Company has been incorporated by H. M., J. J. and L. L. Mundy.

The Houston Street-Railway Company's directors have elected the following officers: President, W. H. Sinclair, of Galveston; Vice-President and General Manager, H. F. McGregor; Superintendent, H. Freund; Secretary and Treasurer, E. H. Bailey, all of Houston.

WISCONSIN.

The Appleton (Wis.) Electric Street-Railway Company has been incorporated by J. E. Harriman and others. Capital, $35,000.

At La Crosse, on March 22d, a street-car broke through the La Crosse River bridge and fell into the river. The horse was killed, the car shattered, and the passengers more or less injured.

New Inventions.

Witmer's Car-Starter.

ABRAHAM R. WITMER, of Safe Harbor, Penn., is the inventor of a new form of car-starter, the construction and operation of which are shown in the accompanying cuts.

The object of this invention is to furnish car-starters so constructed that the momentum of the cars can be stored up and held to be used in starting the cars, and to assist the horses in drawing the cars up heavy grades and around curves, and which shall be simple in construction and easily controlled.

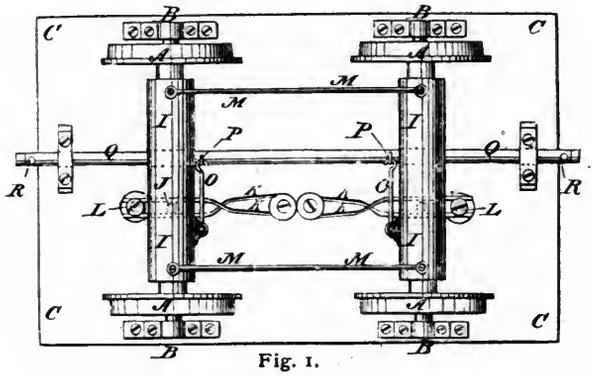

Fig. 1.

WITMER'S CAR-STARTER.

Fig. 1 is an under-side view of the improvement; Fig. 2 is a sectional side elevation; Fig. 3 is a sectional end elevation; Fig. 4 shows one end of the spring disconnected from the axle; Fig. 5 shows one end of the spring connected with the axle, and Fig. 6 a device by which the momentum of the car is held for future use in such manner as to start the car in either direction or in assisting to ascend grades, or pass around curves at street corners.

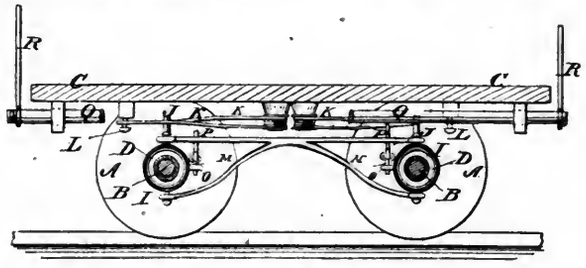

Fig. 2.

WITMER'S CAR-STARTER.

A are the wheels, and B are the axles of a car, which are constructed and connected with the body C, in the usual manner. Upon the middle part of each axle B, is placed a loose sleeve D, around which is coiled a spiral spring E, the sleeve preventing friction between the spiral spring E, and the axle B, when the spring is put under tension. The ends of the spiral spring E, are attached to clutch-collars F, placed loose upon the axle B, and the teeth of which, when the said clutch-collars are left free, are held in gear with the teeth of the clutch-collars G, permanently attached to the end parts of the axle B, so that the two clutch-collars F, and the spiral spring E, will be carried around by and with the axle B, in its revolution. Upon the clutch-collars G, are placed clutch-collars H, which are permanently attached to a tubular case I, and are thus rigidly connected together, so that when one of the clutch-collars H, is in gear with one of the clutch-collars F, the other clutch-collars H F, must be out of gear. The clutch-collars F, equal in thickness the combined thickness of the two concentric clutch-collars G H, so that the clutch-collars F, can gear with either of the clutch-collars G H, or with both at the same time. The case I, surrounds the spring E, and the teeth of all the clutch-collars F G H.

To the upper side of the case I, is attached a pin J, against the opposite sides of which rest the springs K, so as to hold the case in a central position and the ratchet-wheels H, out of gear, and to bring the case into a central position when it is released after being moved in either direction. The springs K, are attached at one end to the car-body A, and their other ends rest against the opposite sides of a pin L, also attached to the car-body A, and which serves as a bearing-point for the springs K, when under tension, and as a stop to prevent the springs from carrying the case I, beyond the central position.

To the upper and lower sides of the end parts of the cases I, or to the screws that connect the clutch-collars H, with the cases, are attached the ends of pairs of rods M, to prevent the case I, from being turned by a strain upon the clutch-collars H.

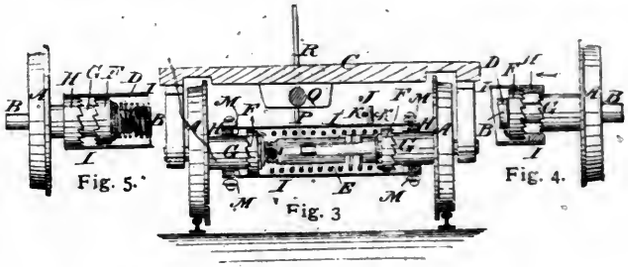

Fig. 5. Fig. 3 Fig. 4.

WITMER'S CAR-STARTER.

To the case I, is hooked or otherwise hinged the end of a rod O, the other end of which is hinged to the lower end of an arm P, rigidly attached to a shaft Q. The shaft Q, is placed longitudinally with the car, and works in bearings attached to the body C, of the car. To the ends of the shaft Q, are attached upwardly-projecting arms R, which may be made long, to serve as levers for the driver to take hold of when operating the mechanism; or the arms R, may be made short to receive a detachable lever, which can be transferred from one end of the car to the other, according as the horses are to be attached to one or the other end. It will be observed that the teeth of the clutch-collars F, project in opposite directions, so that one can be used while the car is going in one direction, and the other when the car is going in the other direction, as shown in Fig. 6, a device whereby is accumulated and held for future use the momentum of the car in such manner as to start the car in either direction or in assisting to ascend a grade, etc. Upon the middle part of each axle B, is placed a loose sleeve D, around which is coiled a spiral spring E, the sleeve preventing friction between the spiral spring E, and the axle B, when the spring is put under tension. The ends of the spiral spring E, are attached to clutch-collars F, placed loose upon the axle B, and the teeth of which when the clutch-collars are left

free, are held in gear with the teeth of the clutch-collars G, permanently attached to the end parts of the axle B, so that the two clutch-collars F, and the spiral spring E, will be carried around by and with the axle B, in its revolution. Upon the clutch-collars G, are placed clutch-collars H, which are permanently attached to a tubular case I, and are thus rigidly connected together, so that when one of the clutch-collars H, is in gear with one of the clutch-collars F, the other clutch-collars H F, must be out of gear. The clutch-collars F, equal in thickness the combined thickness of the two concentric clutch-collars G H, so that the clutch-collars F, can gear with either of the clutch-collars G H, or with both at the same time. The case I, surrounds the spring E, and the teeth of all the clutch-collars F G H.

In operating this device the clutch-collar F, is moved inward in precisely the same manner as in the inventor's first patent; but it carries with it the section of the sleeve to which it is attached, closing the arms of the one upon those of the other until they are completely interlocked (it should be remarked that they are never entirely un-

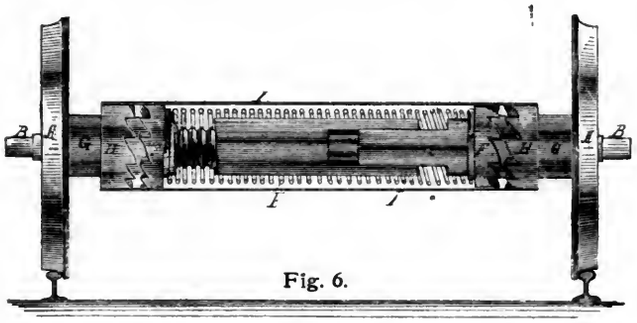

Fig. 6.

WITMER'S CAR-STARTER.

locked), when the whole sleeve is moved toward the clutch-collar F', the screw-sleeve of which engages completely with the main sleeve which locks the wheels. The screw is never entirely free from the sleeve, having a plain cylindrical end, which connects it with the sleeve when the screw is disengaged. Throwing the clutch-collar F, back to its original position stores the required momentum, and still permits the car to be moved. Moving the clutch F', inward brings into action the stored momentum for moving the car. To allow of the action of the device when the car is moving in an opposite direction, the whole action of the clutches, as just described, is reversed.

In using the entire mechanism, when the car is to be stopped the shaft Q, is turned to one or the other side by means of the lever R, which moves the cases I, brings the clutch-collars H, upon one side into gear with the clutch-collars F, pushes the clutch-collar F, out of gear with the clutch-collar G, and holds one end of the spiral spring E, stationary, so that the spiral spring E, will be coiled by the revolution of the axles B, until the car is stopped by the resistance of the springs E. When the car has been stopped, or when sufficient tension has been given to the springs E, the lever R, is released, and the springs K, bring the cases I, back to a central position. As the clutch-collars H, move back, the clutch-collars F, follow them until they come into gear with the clutch-collars G, which hold the clutch-collars F, and thus keep the springs E, coiled. When thus arranged the car can be run for any desired distance without affecting the springs E.

When the car is to be started the lever R, is moved in the other direction, which brings the clutch-collars H, upon the other side into gear with the other clutch-collars F, and pushes the clutch-collars F, out of gear with the clutch-collars G, so that the tension of the spring E, will revolve the axles B, forward and start the car.

When the starter is to be used for assisting the horses in ascending a steep grade, or in running around a curve at a street corner, the lever R, is occasionally operated to gradually coil the springs E, as the car has sufficient momentum to allow this to be done without checking the advance of the car, or when upon a down grade. Then as the car approaches the upper or steeper part of the grade or street corner, as the case may be, and the horses need assistance, the lever R, is reversed to cause the tension of the springs E, to give a forward impulse to the car.

One special and valuable feature of this invention is that in muddy or rainy weather, the car missing a crossing by a few feet, as often happens, is entirely under the control of the driver, who can, by use of the lever, propel the car either backward or forward the necessary distance.

It is claimed for this form of car-starter that it is simple, durable, and effective, and while answering all the purposes for which it is intended will wear well, is not liable to derangement, and fully answers to the various tests to which it would be exposed in actual use.

Bargion's Railway-Rail.

PETER BARGION, of Black Diamond, Cal, is the inventor of an improved railway-rail, which is herewith illustrated and described. The invention relates to that class of compound-rail in which the lower rail is provided with flanges for receiving the central flange or web of the upper section, the object of the invention being to prevent the creeping of the rail.

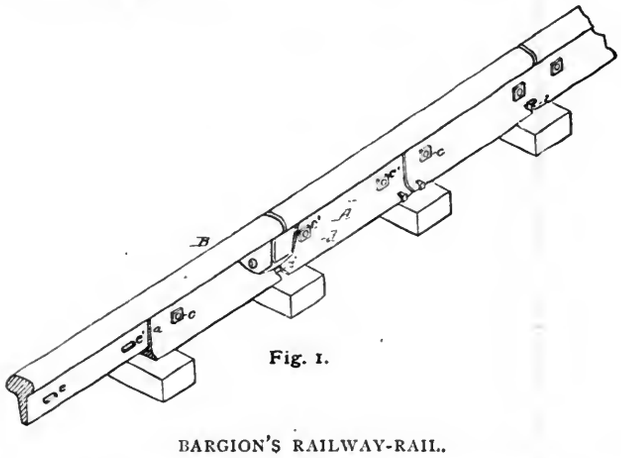

Fig. 1.

BARGION'S RAILWAY-RAIL.

In the accompanying cuts, Fig. 1, is a perspective view illustrating the invention; Fig. 2 a cross-section, and Fig. 3 sections of the parts detached.

The rail consists of the lower section A, of iron, and the upper section B, of steel, the former having two upright flanges *a a*, with inclined inner faces, inclosing a recess *x*, contracting toward the bottom. The central web or flange *b*, of the section B, is not so deep as the recess *x*, the sides correspond in angle to the faces of the recess, and the width is such as to fill completely the recess, so as to permit no lateral movement. When the

section B, is applied to the section A, the web *b*, being if anything slightly wider than the recess *x*, will be forced so tightly between the flanges *a*, as to prevent lateral motion. Owing, however, to the taper of the web and recess, this close fitting of the parts is not effected until the shoulders *y y*, of the head are directly upon their permanent bearings at the edges of the flanges. When, therefore, a train is upon the rail, the head is directly supported by the flanges *a*, while there is no springing or jumping of the section B, and no rattling resulting from the striking together of the parts. Each section B, is bolted immovably to one end of the section A, below by bolts *c c*; but the bolt-openings *e e'*, in the opposite end of the section B, which is supported by the adjacent section A, are elongated for the passage of the bolts *c' c'*, so that the sections are securely bolted together, while the slight longitudinal movement of the upper or lower sections is not prevented, so there is no "buckling" from the expansion of any part of the rail.

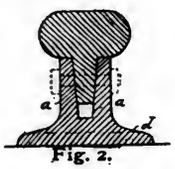

Fig. 2.

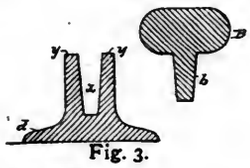

Fig. 3.

BARGION'S RAILWAY-RAIL.

In order to prevent that creeping of the rails upon the sleepers, apt to result when the rail is in two sections of materials expanding unequally, especially when the road is inclined, a notch *i*, is formed in the center of the lateral flange *d*, so that the section A, may be spiked immovably at the center of the sleeper. The other spikes merely overlap the flange, so that each section can expand equally in both directions. As the upper sections are arranged to break joint with the lower sections, it will be apparent that the expanding of the free ends of the sections below each upper rail, being in opposite directions, will tend to prevent any movement of the upper sections, while as each section B, is secured immovably at one end to the lower section, no independent creeping of the upper sections can take place.

It is claimed for this form of rail that it is durable and economical, and prevents effectually the creeping of rails; and forms a continuous, jointless track, thus securing a minimum of friction and no "hammering," while all splices, fish-joints, and shoes are done away with, resulting in less wear and tear to rolling-stock, and uniting increased speed with safety and economy. The device is now controlled by R. S. Bevier, of Owensboro', Ky., to whom all communications should be addressed.

Bellamy's Spring-Cushioned, Hoof-Expanding, Frog-Pressure Horse-Shoe.

LUTHER HALL BELLAMY, of Brockville, Ontario, Can., is the inventor of a new form of horse-shoe, which is herewith illustrated and described. The invention provides a ready-made horse-shoe which will fully care for all the wants of foot, preserve the natural elasticity of the frog and heel, remove or prevent contraction of the hoof, and as nearly as possible resemble the tread of the natural foot. In order to attain these objects the shoe is constructed on scientific principles, so as to distribute the resistant pressure properly over the weight-bearing surfaces of the foot and strictly maintain its natural action and form, and to prevent slipping and the lateral rolling of the foot, which so often causes cutting and interference. Another very important object is to allow perfect knee action, and yet so take the shock of concussion as to avoid all injury to foot or leg, and afford positive relief to the lame or tender-footed horse, and, lastly, to provide for the natural expansion of foot.

In the accompanying cuts, Fig. 1 is a plan view of the bottom of shoe; Fig. 2 a side elevation, and Fig. 3 a rear view in elevation.

A represents the web of the shoe, having nail-holes *a*, and curved inwardly-projecting ends *a' a'*, at the rear. B represents the usual toe-calk. C C are side-calks, D D the heel-calks, and E E the frog-calks. In front of the toe-calk B, is projected a portion *b*, of metal, to contain a nail-hole, so as to make a secure fastening where the shell of foot is strongest and can best stand the lateral as well as the backward strain on the nail. The toe-calk B, is

Fig. 1.

BELLAMY'S SPRING-CUSHIONED, HOOF-EXPANDING, FROG-PRESSURE HORSE-SHOE.

also enlarged at *b b*, so as to provide for the greater wear at these points over the center, and thus cause them to wear off in a horizontal plane.

The side-calks C C, are rocking-calks, located on the web midway between the usual toe-calk B, and heel-calks D D, while the calks E E, on the inwardly-curved rear ends support that part of the web which forms the spring-bearings for frog and cushion for foot. It will thus be seen that seven bearings for the web are provided, namely, one toe-bearing, two side-bearings, two frog-bearings, and two heel-bearings.

In order to prevent the lateral movement of foot, and guard against interfering, lessen the chances of stumbling, and obtain a forward rocking movement of foot at each step, the toe-calk is made shorter than the side-calks, so as to form a slight clearance at toe, and also automatically adapt the tread to the inequalities of road, so that

the hard pavement may feel like natural ground; and in order to obtain frog-pressure the frog-calks are made longer than the adjacent heel-calks, so as first to come in contact with road or pavement. Thus the principal bearing or pressure will be on the frog and side-calks until the full weight of the horse causes the frog to yield to the springing projections E E, when the heel-calks D D, will reach the pavement, thus bringing the lower ends of the

Fig. 2.

BELLAMY'S SPRING-CUSHIONED, HOOF-EXPANDING, FROG-PRESSURE HORSE-SHOE.

heel, side, and frog-calks in the same horizontal plane while that of the toe-calk remains in a higher horizontal plane, so as to allow for the rocking movement of foot at each step, which not only provides a yielding or spring cushion to imitate nature and secure the frog-pressure necessary for health of foot, but also maintains the natural level of foot, prevents the side and forward slip, allows for, the natural expansion of foot, and obtains the forward

Fig. 3.

BELLAMY'S SPRING-CUSHIONED, HOOF-EXPANDING, FROG-PRESSURE HORSE-SHOE.

rocking movement in an easy, natural, and safe way, all tending to greatly improve the knee action and enable the horse to travel on any kind of road with the greatest possible safety and comfort.

It is claimed by the inventor that this device provides a very light and durable shoe, which, being made by machinery, gives accuracy of foot-bearing, fineness of finish, and uniformity of shape; while the cramped movement and shortened step of the horse resulting from the contracted hoof produced by the ordinary horse-shoe, is entirely obviated by this improvement, which provides for expansion of foot, lengthens the step, and produces light and elastic movement.

Broun's Means for Locking Bolts.

NICHOLAS H. BROUN, of Mobile, Ala., is the inventor of an improved means for locking bolts, which is herewith illustrated and described. The object of the invention is to provide means for effectually locking the bolts, which means shall at the same time be inexpensive and durable; and it consists in a series of lugs or projections formed on the face of one section of a fish-plate, so located that when the fish-plate is in close adjustment on the rail the angular heads of the bolts will rest in contact with the lugs and prevent the bolts from turning and fish-plate section from sliding. It further consists in a fish-plate having one section provided with threaded bolt-holes, and the opposite section provided with oblong slots for receiving the bolts, and lugs or projection adapted to slide with the fish-plate beneath the bolt-heads. It further consists in a set of lugs or projections formed on one section of a fish-plate and adapted to form a stop for the rotary motion of the bolt-head, in combination with a set of round bolts, whereby the tendency of the bolt to turn will be increased, and the lock thereby made more effectual.

In the accompanying cuts, Fig. 1 is a view in side elevation of the adjacent ends of two raiis secured by a fish-plate and bolts, showing the improved means for locking the bolts; Fig. 2 a view in side elevation of the opposite side, and Fig. 3 shows the locking section of the fish-plate in position to allow the bolts to turn.

A A' represent the adjacent ends of two consecutive rails. B represents the bolt-locking section of the fish-plate, and *b* the opposite section of the fish-plate. The

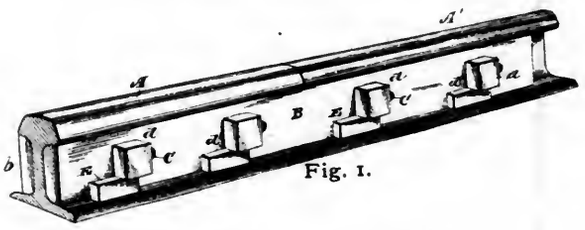

Fig. 1.

BROUN'S MEANS FOR LOCKING BOLTS.

section *b*, is provided with a series of screw-threaded perforations *c*, which are adapted to receive the threaded ends of the bolts D. The section B, of the fish-plate is provided with a series of oblong slots C, corresponding to the threaded perforations *c*, which slots are sufficiently wide to admit the bolts D, and long enough to allow the section B, to slide longitudinally thereon a distance equal to about half the diameter of one of the bolt-heads *d*. The bolt-heads *d*, are preferably square, but may be of other angular shapes, if found desirable. The section B, is further provided with a series of lugs or projections E, located below and to one side of the slots C. The projections E, are located on the left-hand side of the slots, or on that side toward which the upper portions of the bolt-heads turn in unscrewing. The upper faces of the projections E, are level, and are located a distance below the centers of the slots C, equal to the distance from the

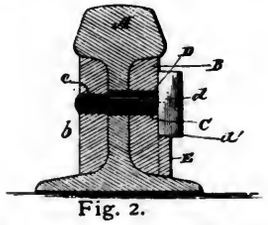

Fig. 2.

BROUN'S MEANS FOR LOCKING BOLTS.

center of one of the bolt-heads to the middle of one of the sides of the bolt-head. When the section B, is slid toward the left, with the bolts in the extreme right-hand ends of the slots C, the ends of the projections E, will be far enough from the bolt-heads to admit of the free use of a wrench, and in this position the bolts may be screwed into the fish-plate section *b*. When the bolts are screwed home and left with one of their sides, the lowest side, parallel with the tread of the rail, or with the face of its lug, the section B, may be driven to the right, sliding the lugs E, beneath the bolt-heads until the bolts occupy the extreme left of the slots C. It will be observed that the

bolt-heads, and hence the bolts, are now absolutely locked against a rotary motion toward the left as long as the lugs occupy their present positions, and as the tendency of the bolts is constantly to turn toward the left, or unscrew, the left-hand lower corners *d'*, of the heads will impinge against the faces of the lugs E, and tend to hold the section B, from sliding toward the left, and, in case there should be any play left between the faces of the lugs and the bolt-heads, would tend to slide the section B, toward

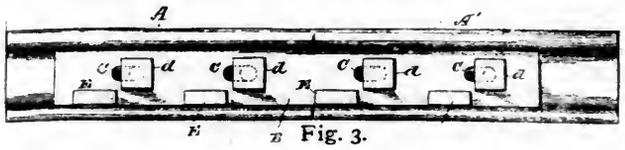

Fig. 3.

BROUN'S MEANS FOR LOCKING BOLTS.

the right. It is evident that the greater the tendency of the bolt to unscrew, the more securely will the section B, be locked against displacement. To enable the bolts to have a stronger tendency to unscrew, they are made round instead of angular.

The advantages of the above-described means for locking the bolts consist in the saving of loose nuts on the ends of the bolts, the convenience with which the fish-plates are adjusted and removed, the small number of parts employed, and the perfect freedom from wear on the parts, and finally the absolutely sure and permanent locking of the bolts.

The device is now controlled by the inventor and by George A. Pearce, of Mobile, Ala.

Chapman's Lifting-Jack.

THOMAS L. CHAPMAN, of Richmond, Va., is the inventor of a new and improved form of lifting-jack, which is herewith illustrated and described. This device belongs to that class denominated "lifting-jacks;" and the novelty consists in the peculiar construction of the device in its several parts and in the device as a whole, all as will now

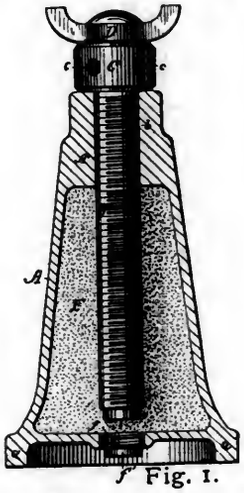

Fig. 1.

CHAPMAN'S LIFTING-JACK.

be more fully set out and explained, reference being had to the accompanying cuts.

In the accompanying cuts, Figs. 1 and 2 represent vertical central sections of the present invention.

A denotes the body of the jack, which is usually of a generally triangular shape from top to bottom—that is, it is larger in diameter at the base than at the top. Centrally through the upper part A', of the body is the screw-threaded aperture *b*, in which the screw C, is moved, and in the lower part of the body is the chamber F, of any desired shape or size. This chamber is denominated the "grease-chamber," because it is filled with any desired lubricant, and this is preferably done through the aperture *f*, in its base, which aperture is suitably closed by a plug, cover, or screw-cap *f'*, or the filling-aperture may be at the side. In some forms of construction it may be found desirable to fill this chamber through the screw-hole in the top, the chamber being otherwise closed. Circumferentially about or around the base is a flange *a*, on which the jack rests; but the jack may be so made as to rest on a flat bottom, the under side of the bottom of the grease-chamber being recessed or counter-sunk to take the screw-cap or cover or plug of the filling-aperture. The head C', of the screw is provided with the usual apertures *c*, and on its upper end there is the usual swiveling head D.

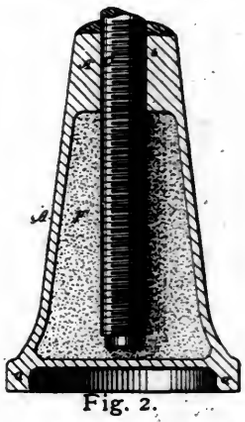

Fig. 2.

CHAPMAN S LIFTING-JACK.

The operation of the lifting-jack is as follows: The grease-chamber having been properly filled and the screw placed in its hole or socket, it is only necessary to screw it up and down once or twice to thoroughly lubricate its entire thread and the socket, and if at any time it is necessary to further lubricate the screw-thread or socket the operation is repeated; but generally the mere use of the screw will keep its socket and the whole stem suitably lubricated. In ordinary construction it has been found very difficult to keep the screw of a lifting-jack well lubricated, so as to be in good working order for any considerable time. This has chiefly happened because the body of the jack being open a considerable part of the screw has been exposed to the air. Thus in cold weather the grease would harden, in hot weather it would run off, and in dusty weather it would get grimed. In addition to these objections, any exposure of the jack will soon cause the screw to rust; but it is claimed that in the present device all these difficulties are fully obviated, and the screw is always in good working order. Nor does the present construction add in any perceptible manner to the weight or cost of the device, while in all details of use it is adapted to every purpose required of a lifting-jack, and its real value as a tool or implement very greatly increased.

The inventor has assigned a one-half interest in his patent-rights to Clinton Lloyd, of Williamsport, Penn., to whom all communications should be addressed.

Ingersoll's Car-Coupling.

CHARLES M. INGERSOLL, of Summit Hill, Pa., is the inventor of a new form of car-coupling, the construction and operation of which are shown in the accompanying cuts. Fig. 1 is a side elevation of one of the car-couplings shown uncoupled; Fig. 2 a plan view of one part of the same, part of the link being broken away; Fig. 3 a front elevation of a part of the same; Fig. 4 a sectional side elevation of a part of the same, and Fig. 5 a plan view of the coupling bar or link.

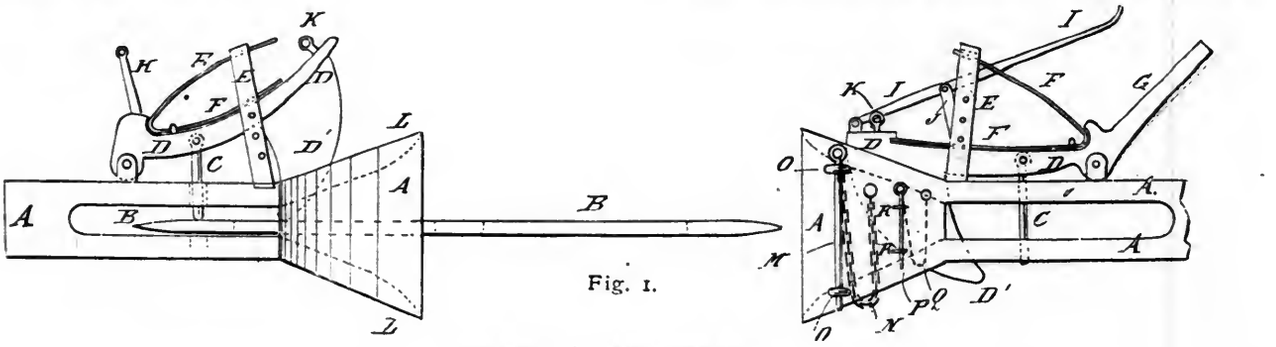

Fig. 1.

INGERSOLL'S CAR-COUPLING.

A represents the draw-heads, the mouths of which are made hopper-shaped, as shown in Figs. 3 and 4, and indicated in dotted lines in Fig. 1. The shanks of the draw-heads A, are slotted longitudinally and horizontally, to allow the ends of the coupling-bar B, to have a free lateral movement, and the height of the slots are made enough greater than the thickness of the coupling-bar B, to allow the ends of the coupling-bar B, to have the necessary vertical play. C are the coupling-pins, which pass down through holes in the shanks of the draw-heads A, and through slots in the end parts of the coupling-bar B. The upper ends of the coupling-pins C, are pivoted to latches D, at a little distance from their rear ends, so that the pins will be raised and lowered by the up and down movements of the latches. The latches D, are pivoted at their rear ends to lugs formed upon or secured to the upper sides of the shanks of the draw-heads A, and their forward

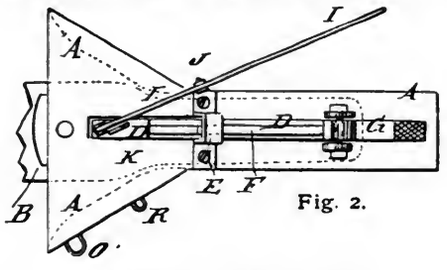

Fig. 2.

INGERSOLL'S CAR-COUPLING.

ends extend nearly to the forward ends of the draw-heads. Upon the lower sides of the forward ends of the latches D, are formed downward projections D', the inner edges of which are concaved, and their outer edges are convexed, giving to the projections a hook form, as shown in Figs. 1 and 4.

The projections D', of the latches D, work in slots in the upper and lower parts of the draw-heads A, and the latches D, are made to move up and down in vertical planes by keepers E, attached to the upper sides of the draw-heads, and are held down by V-shaped springs F, which are secured at or near their angles to the rear parts of the latches D, with their lower arms resting upon the upper sides of the latches, and with the ends of their upper arms passing through the upper parts of the keepers E, and bearing against the bends of the keepers. With this construction, when two cars are run together the entering end of the coupling-bar B, strikes against the convexed forward edge of the projection D', and raises it and the latch D, and pin C, passes in beneath the lower ends of the projection and pin until they drop through the slot in the coupling-bar B. The coupling-bar B, is made with tapered ends, as shown in Figs. 1 and 4, and the ends are made solid for such a distance that the ends of the projections D', will rest upon the ends until the ends have passed beneath the lower ends of the coupling-pins C, which then rest upon the solid ends until they slide off into the slots of the coupling-bars, and the cars are coupled, the draft-strain coming wholly upon the coupling-pins C.

The center of the coupling-bar B, is made solid, to give it the necessary strength, and the middle part of the bar is widened and has the ends of the widened part beveled, to correspond with the flare of the mouths of the draw-heads, so that the distance to which the coupling-bar

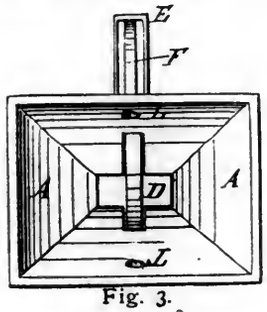

Fig. 3.

INGERSOLL'S CAR-COUPLING.

enters the draw-heads will be limited by the widened part of the coupling-bar coming in contact with the inner surface of the draw-heads. Upon the pivoted rear end of each latch D, can be formed, or to it can be rigidly attached, an arm G, to serve as a foot-lever for raising the latch D, to uncouple the cars, or an arm H, to receive a chain connected with a lever pivoted to the front of the car-body; or to the forward end of the latch D, can be pivoted the forward end of a lever I, the middle part of which is pivoted to a standard J, attached to the shank of the draw-head; or to the forward end of the latch D, can be attached an eyebolt K, to receive a chain connected with the top of the car-body, or to serve as a handle for raising the latch and uncoupling the cars.

A hole L, is formed through the forward part of each

draw-head A, to receive an ordinary coupling-pin M, when it is necessary to couple a car provided with the improved coupling with a car provided with the ordinary pin-and-link coupling. The coupling-pin M, is connected with the draw-head A, by a short chain N, so that it cannot be lost, and when not required for use is inserted in keepers O, attached to the side of the draw-head A.

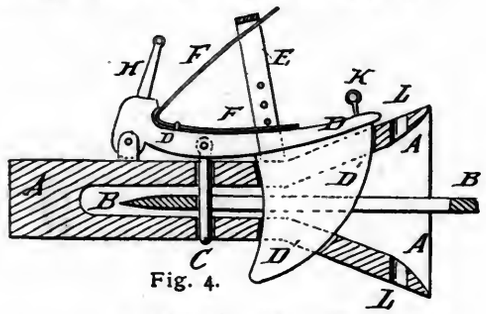

Fig. 4.

INGERSOLL'S CAR-COUPLING.

When it is desired that cars may be run together without coupling, the latch D, and pin C, are secured in a raised position by a pin P, inserted in a hole formed in the keeper E. This pin P, is connected with the draw-head A, by a short chain Q, to keep it from being lost, and when not required for use is inserted in keepers R, attached to the side of the draw-head A.

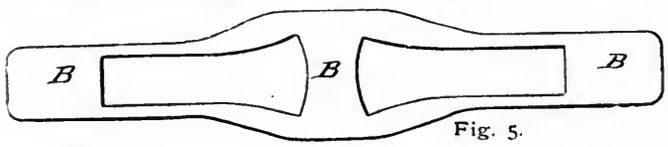

Fig. 5.

INGERSOLL'S CAR-COUPLING.

It is claimed for this form of car-coupling that it is simple, durable, and inexpensive, and not liable to derangement. It will couple automatically irrespective of the speed of the cars in coming together, and on curves or grades. The moment cars are uncoupled the device assumes the position to couple again automatically without readjustment of its parts, and will never accidentally uncouple.

Morse's Nut-Lock.

JAMES F. M. MORSE, of Evansville, Ind., is the inventor of an improved form of nut-lock, which is herewith illustrated and described. A chief object of the device is to provide a nut-lock that will admit of the frequent adjustment of the nut without injury to the lock.

In the accompanying cuts, Fig. 1 represents a side elevation of a bolt and nut with the nut-lock attached; Fig. 2 an end view of the same; Fig. 3 a central longitudinal section at a right angle to Fig. 1; Fig. 4 a view in perspective of the parts of the lock separated, and Figs. 5 and 6 represent modifications of the device.

A short portion *b*, of the outer end of the bolt is reduced and made angular in section. *c* is a washer adapted to pass over the bolt and to embrace the nut on two sides. *d* is a flat plate having a central perforation *j*, corresponding in size and outline to the angular portion *b*, of the bolt, and adapted to interlock with the projecting ends of the washer *c*. In Figs. 1, 2, 3 and 4 the washer *c*, is provided with arms *e* and *f*, which lie normally close along two opposite sides of the nut *g*, and project outward beyond the face of the nut. These projecting ends of arms *e* and *f*, are notched on each edge, so as to form T-shaped heads, which pass through corresponding slots *h* and *i*, in the plate *d*, and engage the plate on the outside.

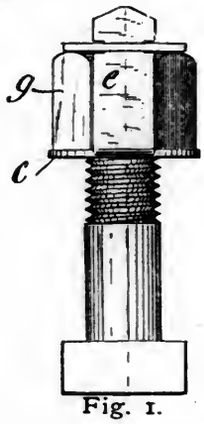

Fig. 1.

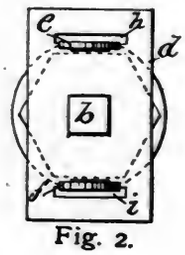

Fig. 2.

MORSE'S NUT-LOCK.

In operation, the nut is placed between the arms of the washer *c*, and is then screwed onto the bolt, the washer turning with the nut. When the nut has been screwed down sufficiently, the plate *d*, is slipped over the projecting ends of the arms *e* and *f*, and the squared portion *b*, of the bolt, the arms being forced slightly apart, so as to enter the wider portion of the slots in the plate, and then springing toward each other into the narrower portion of the slots when the plate has reached the notched portion of the arms. The nut is thus held in position by the engagement of the arms with the plate, which is held in a fixed relation with the bolt by the engagement of its central hole *j*, with the squared portion of the bolt. When

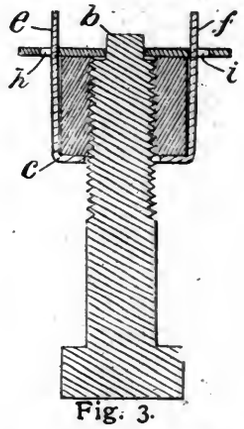

Fig. 3.

MORSE'S NUT-LOCK.

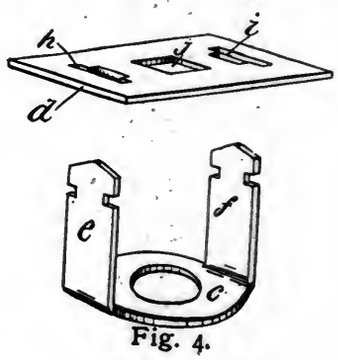

Fig. 4.

MORSE'S NUT-LOCK.

the nut is to be again turned, it is only necessary to release the hold of the arms upon the plate *d*, when the plate may be removed.

In the modification of the device as shown in Fig. 5, the ends of the arms *e* and *f*, instead of being notched to engage with the plate *d*, are simply bent outward, as shown, thus retaining the plate on the bolt. In Fig. 6

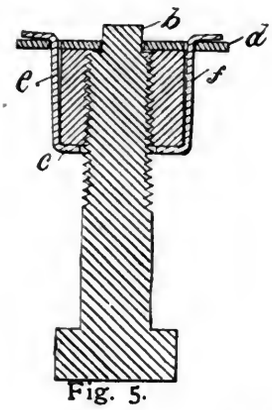

Fig. 5.

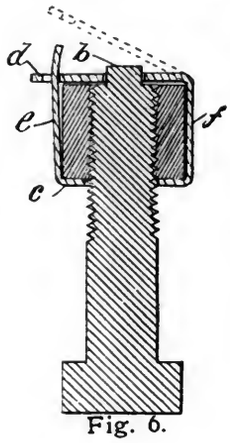

Fig. 6.

MORSE'S NUT-LOCK.

the plate *d*, is shown as formed integral with one of the arms of the washer *c*, and interlocked with the other arm. In this case, when the nut is to be turned, the plate is bent outward, as indicated by dotted lines.

This device is claimed by the inventor to provide a simple, durable, inexpensive and reliable nut-lock.

Peet's Ticket-Holder.

WARREN L. PEET, of Maple Rapids, Mich., is the inventor of a new and improved form of ticket-holder, which is herewith illustrated and described. This invention relates to ticket-holders, and has for its object to provide a simple and convenient form of ticket-holders for railway-cars.

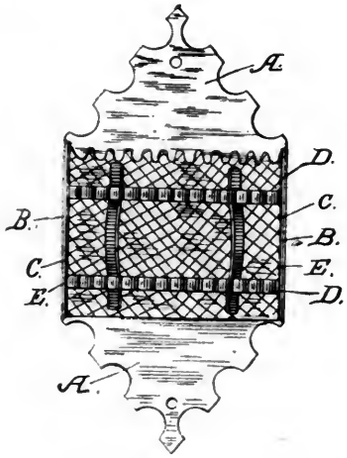

Fig. 1.

PEET'S TICKET-HOLDER.

In the accompanying cuts, Fig. 1 is a front view, and Fig. 2 a plan view of the device.

In carrying out the invention a main or back plate A, is provided, the opposite side edges of which are bent slightly, forming flanges B, as most clearly shown in Fig. 2. The ticket-support is formed with the wings C C, preferably bent from a single plate of perforated metal, or suitable open-work, as shown in Fig. 1, into the triangular form (more clearly shown in Fig. 2) and having its edges placed against the flanges B, and soldered or otherwise suitably secured thereto. In use the back-plate is secured to the inside of the car, and the wings C C, face in different directions, as shown. Strips D D, of crimped metal, are secured at each end to the ticket-holder, and in horizontal lines near the upper and lower ends thereof. These strips D, extend from the joint of one wing with the main plate to the joint of the other wing therewith, as shown. Vertical strips E, are also provided, arranged one midway the sides of each wing. Each of the strips E, is secured to its respective wing in such manner that its central portion is bulged sufficiently out from the wing.

A ticket-holder is supplied to each seat of the car, and arranged so that they may be conveniently seen by the conductor at all times. By crimping the strips D, and attaching them to opposite edges of the wings, sufficient

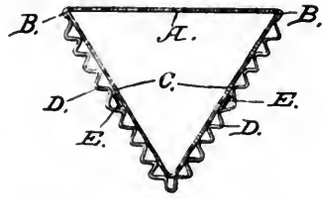

Fig. 2.

PEET'S TICKET-HOLDER.

play may be had for the insertion of the vertical strips E, which may or may not be of spring metal, and for the insertion of the tickets between the wings and the strips, the folds of the strip expanding to allow it to accommodate itself to the bulk of the tickets. As the strips E, which may be of any desired number not exceeding the number of folds in the strip D, are held between the folds of the latter, they are caused to retain their relative positions, and prevented from having any lateral movement. The strips E, being bulged, afford an easy means of grasping the same when it is desired to insert a ticket between them and the wings. Furthermore, this bulge prevents the slipping or vertical displacement of the strips, as will be readily understood from Fig. 1.

It is claimed for this invention that it is simple in construction, and may be made at slight cost. By its use the passenger may at all times have his ticket or check in view, and the inconvenience of being repeatedly asked to exhibit same is obviated.

Muddiman's Hose-Coupling.

CHARLES A. MUDDIMAN, of Washington, D. C., is the inventor of a new form of hose-coupling, which is herewith illustrated and described. The object of the invention is to enable a joint to be easily and quickly made between sections of a hose, or between a hose and a plug; and to this end consists in the construction and combination of parts, substantially as and for the purpose hereinafter shown.

In the use of hose for liquids it has heretofore been customary, in connecting two pieces together, or when connecting the hose with a plug, to employ couplings having square abutting ends, and to depend upon an elastic washer placed between the same for the production

of a joint; but such means have proved defective, especially in connection with hose employed for watering lawns, sprinkling streets, etc., which is usually manipulated by inexperienced persons.

In the accompanying cuts, Fig. 1 is a perspective view of the parts of the coupling separated from each other; Fig. 2 is a like view of the same united; Fig. 3 is a central longitudinal section of the coupling; Fig. 4 is a perspect ive view of a supplemental plug for use upon the plug of an ordinary street-washer or hydrant, and Fig. 5 is vertical central section of the same.

In the carrying of the invention into practice a thimble A, having the usual grooved periphery is inserted into the end of a hose B, and confined therein by wire C, wound around the exterior of said hose, or by any other means ordinarily employed. The projecting end a, of the thimble A, has a general bell shape, and within its interior is provided with a conical face a', that at its inner end is merged in the axial opening a^2, of the sleeve. The opposite

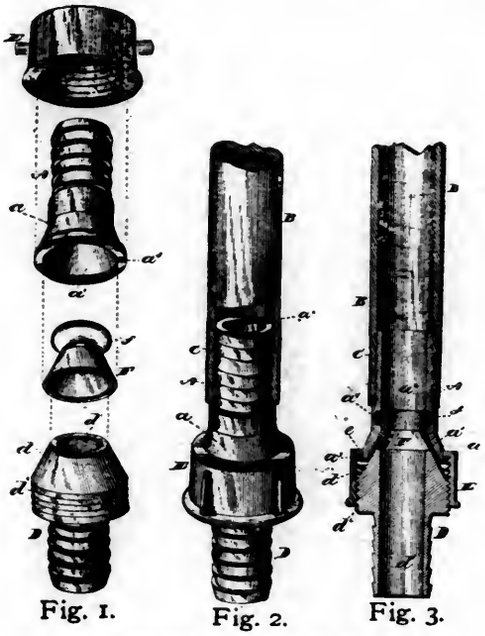

Fig. 1. Fig. 2. Fig. 3.

MUDDIMAN'S HOSE-COUPLING.

thimble, or if part of a hydrant, the plug D, has a conical face d, formed upon its end, which face corresponds to and is adapted to fit within the conical face a', whereby the axial opening d', within the plug will be caused to coincide with and form a continuation of the opening a^2. The periphery of the plug D, is somewhat larger in diameter than the end of the thimble A, and is provided with a screw-thread d^1, and over the same is fitted a sleeve E, which is threaded interiorily. Said sleeve is swiveled upon the thimble A, in the usual way, the latter being provided at its end with a radially outward projecting flange a^3, that is engaged by a radially inward projecting flange e, which is formed at the upper end of the sleeve. If, now, the hollow conical end of the thimble A, is placed over or upon the conical end of the plug D, and the sleeve E, screwed down around the latter, the parts will be firmly bound together, and their bearing-faces a' and d, will be held in contact.

In order that a tight joint may be formed between the thimble A, and plug D, a rubber washer F, is placed between the faces a' and d, which conforms to the shape of the faces, and by the action of the sleeve E, is compressed between the same. To prevent displacement and loss of the washer F, it is loosely attached to the thimble A, by means of a rib f, that is formed upon the periphery at the upper end of the washer, and fits into a corrresponding circumferential recess a^4, which is provided within the axial opening a^2, of the thimble. Thus constructed, the washer may be readily placed in or removed from position when desired, as its enlarged part is easily compressed while passing through the neck of the recess a^4; but the connection between the parts is sufficient to prevent their accidental separation during any ordinary use of the hose.

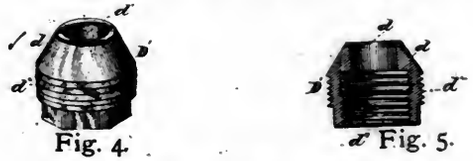

Fig. 4. Fig. 5.

MUDDIMAN'S HOSE-COUPLING.

It will be seen that, if desired, the elastic washer F, may be readily attached to the plug D, instead of the thimble A, for which purpose it will only be necessary to provide a rib at the lower end upon the inner side of the washer and a corresponding groove within the periphery of the plug.

For use with an ordinary street-washer, a supplemental plug D', as shown in Figs. 4 and 5, is employed. which is like the plug D, before described, except that instead of the grooved lower end for insertion within a hose the plug D', has within its lower portion a threaded interior d^3, that is adapted to fit over the plug of such street-washer. The plug D', after having been placed in position, need not be removed with the hose.

It claimed for this form of hose-coupling that it is simple, effective, and economical, and is equally well adapted for use in connection with either steam, air, oil, or water.

Chandler's Dressing-Closet for Sleeping-Cars.

ADONIRAM J. CHANDLER, of Cincinnati, Ohio, is the inventor of an improved and novel form of dressing-closet adapted for use in sleeping-cars, which is herewith illustrated and described. The object of the invention is to provide a shelter or screen for use upon sleeping-cars of

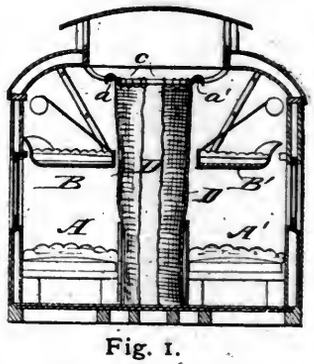

Fig. 1.

CHANDLER'S DRESSING-CLOSET FOR SLEEPING-CARS.

the Pullman model, whereby the occupants may stand upright in the aisle and dress without being within sight of other passengers; and the invention consists of a supporting-frame carrying curtains, said frame being so ar-

ranged that it may readily be attached to or disconnected from the curtain-rail of the car, and of certain details of construction and combination of parts, to be hereinafter described, and specifically pointed out.

In the accompanying cuts, Fig. 1 is a vertical cross-sectional view of the body of a sleeping-car, representing the dressing-closet as applied thereto; Fig. 2 a perspective view representing a portion of a section with the closet in position for use, and Fig. 3 a similar view representing the frame as detached or unlocked from the curtain-rail across the aisle from the entrance to the closet.

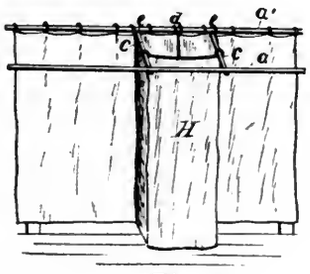

Fig. 2.

CHANDLER'S DRESSING-CLOSET FOR SLEEPING-CARS.

Referring now to the construction shown in Fig. 1, A A′ represent the lower, and B B′ the upper berths of an ordinary sleeping-car, before which the usual curtains are hung from the rails *a a′*. In the ordinary and usual form of construction it is very difficult for passengers to dress and undress without exposing themselves to the view of their fellow travelers, as the dressing must be done in the open aisle or in the berth, which, as is well known, is very inconvenient.

The closet consists of a curtain D, of any proper material, that is secured to the rods C, as shown in Fig. 2, and provided with hooks *e e*, and hooks *e e*, being at the ends of the rods and arranged so that they may be caught upon the curtain-rail *a′*, that is above the section containing the travelers who wish to use the closet. When placed as described, the opening *d*, will be sufficient to allow a person to enter the closet, but, being toward the vacated

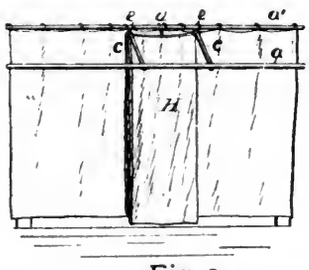

Fig. 3.

CHANDLER'S DRESSING-CLOSET FOR SLEEPING-CARS.

berth, will not interfere with the seclusion thereof, and after the sections are made up the closet may be suspended from rail *a′*, as shown in Fig. 3.

Instead of a rod *c*, the top of the closet might be made from a circular board provided with hooks arranged so as to correspond relatively with the hooks *e e*. During the day the closet may be taken down and packed away with the mattresses.

It is claimed for this form of dressing-closet that it is simple, and inexpensive of construction, and effects a far more comfortable opportunity of dressing in transit than any method hitherto used, as it supplies each section with a practically distinct and separate dressing-room. The patent is under the sole control of the inventor, to whom all communications should be addressed.

Desmond's Injector.

THE object of the above invention, which is herewith illustrated and described, is to construct a new form of lifting injector composed of fewer parts, and of a simpler construction than any heretofore devised.

In the accompanying cuts, Fig. 1 is a vertical central longitudinal section of the injector, and Fig. 2 a cross-section on the line *x x* in Fig. 1.

A is the tubular main casting or shell of the injector. This is provided with inlet and discharge openings at the ends, and has the lateral branches B and C. D is a suitable coupling by means of which the steam-pipe which conveys the steam from the boiler is connected to the inlet-opening of the shell. E is a hollow screw-plug secured in the discharge-opening of the shell A, and forms a discharge-chamber P. F is another suitable coupling,

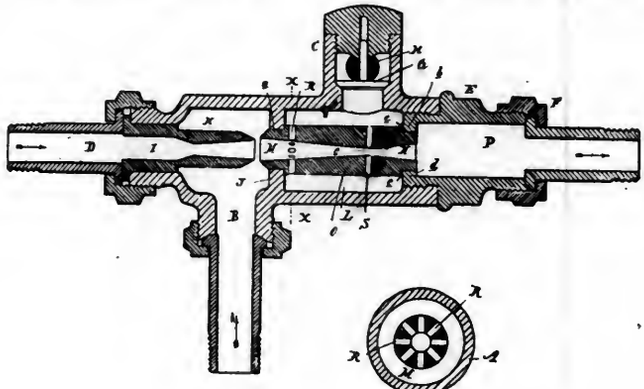

Fig. 1. Fig. 2.

DESMOND'S INJECTOR.

by means of which the discharge end of the hollow screw-plug E, is connected to the feed-pipe, which conveys the feed-water into the boiler. The lateral branch B, forms the inlet-opening for the supply-water, and connects with the water-supply pipe to the well. The lateral branch C, forms a chamber and seat for the overflow-valve G, and is provided with the outflow H, for the overflow. I is the steam-nozzle, removably secured in the inlet-opening of the shell. J is a diaphragm-plate formed integrally with the shell A. It divides the chamber K, which communicates with the water-supply from the overflow-chamber L, which communicates with the overflow-outlet H, whenever the overflow-valve G, is raised off its seat. M is the combining-tube, and N is the discharge tube. These tubes are combined into one piece O, of cylindrical form, provided with necks *a* and *b*, at the ends.

The diaphragm-plate J, is provided with a central opening, into which the neck *a*, of the tube O, is fitted, so as to make the forward end of the combining-tube project slightly within the chamber K, and in proximity to and directly opposite and in line with the discharge end of the steam-nozzle. The neck *b*, of the tube O, is fitted into a corresponding opening of the flange-bushing *d*, which latter is formed at the inner end of the screw-plug

E, and packing *c*, may be used to form a tight joint. The cylindrical tube O, forms a dividing-wall between the annular overflow-chamber L, and between the combining-tube M, and delivery-tube N, through which the following passages are provided. Near the base of the combining-tube M, communication is established between the interior of the combining-tube and the overflow-chamber L, by means of a series of radial holes R, formed through the wall of the combining-tube as near its base as practicable. S is an overflow-passage formed through the wall of the tube O, and affording communication between the overflow-chamber L, and the throat *e*, which forms the intermediate connection between the combining-tube and discharge-tube.

The operation of the injector is as follows: Steam being at once fully admitted into the injector it will quickly force its way through the steam-nozzle into the combining-tube and from there through the passages R, into the overflow-chamber, and after raising the valve G, out into the air through the opening H. As there is an ample and free exit for the steam which passes through the steam-nozzle into the combining-tube, there will be a strong aspiration into the combining-tube and the water in the supply-pipe will be raised. If the distance is within the ordinary limit, the water will be raised into the water-chamber K, and from there be drawn through the combining-tube into the overflow-chamber, and escape through the opening H. As the velocity of the water in the combining-tube increases, the port S, in affording further relief, will throw the whole combining-tube into operation until the velocity of the water becomes sufficient to force it against the boiler-pressure, when the over-flow ceases, and the valve G, will close under the action of the vacuum created.

It is claimed for this invention that it is simple in construction, and can be readily and inexpensively manufactured. It it also claimed that it will keep its priming much longer than a more complicated device of the same character, and is adapted to use on all kinds of engines, especially traction and marine, where subject to severe jarring, there being no moving parts to get out of order.

At a recent test ordered by the United States Government at the Norfolk Navy Yard, a report was signed by S. D. Hibbert, chief engineer, and others speaking in high terms of the results of 31 days trial of this injector.

The device is now known as the Michigan Automatic Injector, and is entirely controlled by Roe Stephens, of Detroit, Mich., to whom the patent-rights have been assigned.

Gabel's Car-Coupling.

ALFRED N. GABEL, JR. and ARTHUR L. GABEL, of Onarga, Illinois, are the inventors of a new and improved form of car-coupling, which is herewith illustrated and described. The invention relates to an improvement in car-couplings, and it consists in the certain peculiarities of the construction and arrangement of the same, as are fully described below.

In the accompanying cuts, Fig. 1 is a perspective view of the coupling applied to a car, and Fig. 2 a longitudinal vertical section of the same.

a represents a car, and *a'* the draw-bar, both of which are of ordinary and well-known forms. In the draw-bar is pivoted a hook *b*, for engaging the link, the rear end of which is extended beyond the pivot and rests upon a spring *b'*, which acts to throw the hook down and retain it in place, as shown. The forward end of the hook-arm is formed with shoulders b^2, which fit into recesses b^3, of

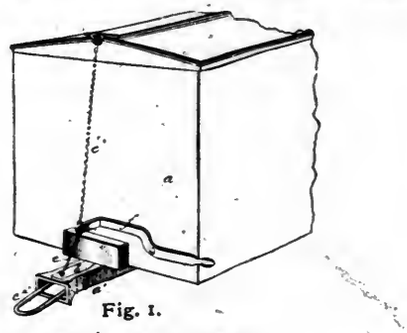

Fig. 1.

GABEL'S CAR-COUPLING.

the draw-head, and the point of this hook is formed with small notches *c*, which rest upon and receive the edge of the recess or hole *c'*, in the bottom of the draw-head, and effectually prevent any twisting of the hook under the action of the link. The forward side of the hook is rounded or beveled off to admit of the link c^2, easily lifting the hook as it passes in, and in rear of the hook the draw-head is cast or formed with an abutment *d*, to pre-

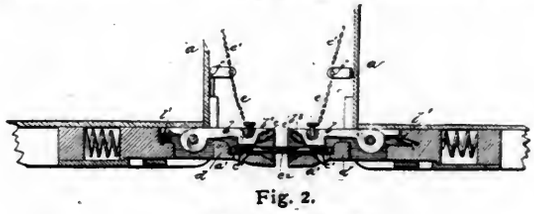

Fig. 2.

GABEL'S CAR-COUPLING.

vent the link going too far back. A chain *e*, is attached to the upper side of the hook and led to the end of a lever *f*, pivoted on the car-body within easy reach from the side, so that the operator need not pass between the cars and run any risk of accident. A second chain *e'*, is attached to the lever and extended to the roof of the car, to permit the coupling to be operated from that point. It will be seen that the link automatically lifts the hook as it enters, and it drops back by the action of the spring to couple the cars.

It is claimed for this form of car-coupling that it is simple, durable, and economical, and may be readily attached to any draw-head.

Neary's Process for Renovating Car-Seats, Etc.

GEORGE F. NEARY, of Brooklyn, N. Y., is the inventor of a new process for renovating car-seats and furniture, and upholstery of all kinds on railway and street-railway cars, steamships and hotels, and all public buildings. By this process the furniture need not be removed, and the renovation can be completed in two days. Plushes, silks, satins, carpets, and fabrics of all kinds, as well as leather and all forms of seat-coverings, can be restored to their original color and freshness, no matter how faded and stained, and without the slightest injury to the texture of the goods. It is claimed that a railway-car can be renovated and put in thorough order, and made in every way

as good as new at less than one-tenth the expense of re-upholstering.

Railway-cars have been renovated by this process on the Pennsylvania, the Long Island, the New York, New Haven and Hartford, and other railways, with entire satisfaction, and a number of ocean steamers, including the *City of Richmond, City of Berlin*, and others, have also been renovated, and the work has received the endorsement of the officers of the vessels, including the Clyde Steamship Company, to whom the process has given entire satisfaction.

The process is now entirely controlled by the Oriental Restoring and Renovating Company, of 132 Broadway, New York City.

Patterson's Automatic Railway-Gate.

JAMES K. PATTERSON, of Crete, Nebraska, is the inventor of a new form of railway-gate, the construction and operation of which is herewith illustrated and described. The gate is designed to fall across the track at crossings in order to prevent cattle from straying on the lines, and should be a useful device especially in those sections where stock roams at large.

The invention provides a practical and reliable railway-gate adapted to be automatically opened by the weight of a train, and closed, mainly, by its own gravity; and consists of the construction, arrangement, and combination of parts, all as hereinafter described.

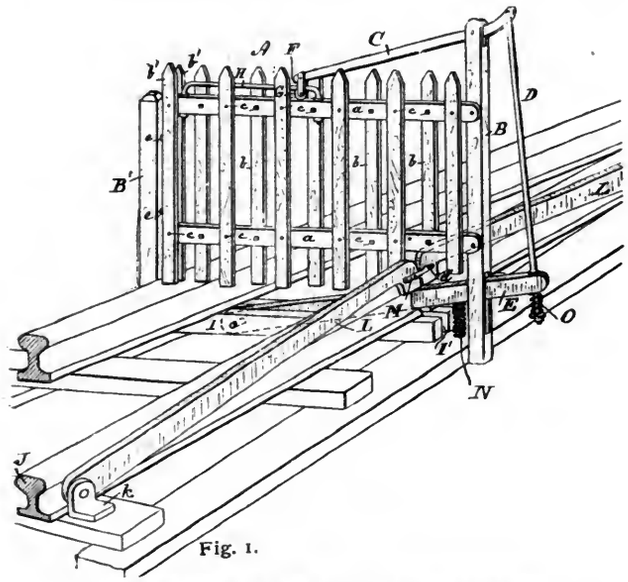

Fig. 1.

PATTERSON'S AUTOMATIC RAILWAY-GATE.

In the accompanying cuts, Fig. 1 is a perspective view of the device as it appears when closed across the track, and Fig. 2 a similar view of the gate as it appears when open.

A represents the gate. This is composed of the main bars *a a*, pivoted to the post B, and the pickets *b b'*, pivoted or hinged by bolts *c c*, to the bars *a a*, so that the gate may be opened vertically, as shown in Fig. 2. To the upper end of the post B, is pivoted the lever C. This is connected at one end by the connecting-rod D, to the lever E, while at its opposite end it is connected by the link F, and grooved roller G, to the iron H, secured to the upper edge of the upper bar *a*. The lever E, is pivoted in the railway-tie I, which is slotted longitudinally, as shown at I', to receive it.

To the outside of and parallel with the railway-rail J, are bolted to angle-plates *k*, the two levers L L, the adjacent ends of which rest upon the lever E, as shown clearly in the cuts. The upper edges of the levers L L, normally stand above the upper surface of the rail J, except at the plates *k*, where they are on a level with or slightly below the upper surface of the rail, so that the wheels of a railway-train in passing will run upon the upper edges of the levers L L, and gradually depress their adjacent ends, and through them depress the lever E, which in turn wil

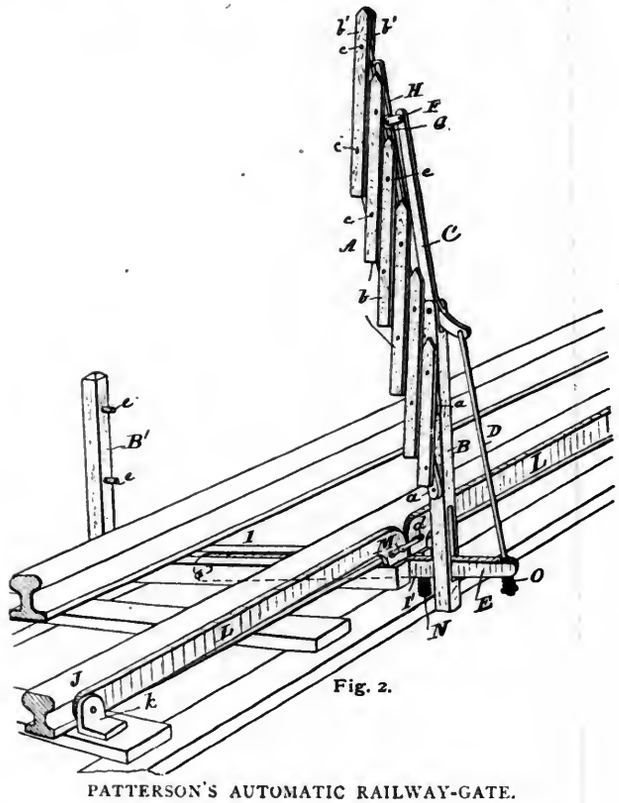

Fig. 2.

PATTERSON'S AUTOMATIC RAILWAY-GATE.

draw downward the short arm of the lever C, causing the long arm of this lever to open the gate by elevating it to the position shown in Fig. 2.

The levers L L, are caused to work simultaneously by being joined together by link M, made fast to one lever and entering the slot *d*, of the other. Beneath the lever E, is placed the spring N, that is compressed when the lever E, is forced downward, as described, and the reaction of the spring assists in closing the gate automatically after the train has passed the levers L.

Upon the rod D, below the lever E, is placed the coiled spring O, to cushion the downward motion of the lever E, and prevent the gate A, from being injured in opening, and this spring O, also cushions or prevents the gate from closing too suddenly. Opposite to the post B, is placed the post B', which, in this instance, is provided with the pins *e e*, that enter between the two outer pickets *b' b'*, of the gate, and prevent the gate from having lateral movement.

It is claimed by the inventor that the device is simple, durable, and economical, while it efficiently serves the purpose for which it is intended.

GENERAL OFFICES **THE ROTE AUTOMATIC BRAKE COMPANY,**

MANSFIELD, OHIO, *November 3d, 1884.*

To the Westinghouse Air Brake Company, Pittsburgh, Pa.:

GENTLEMEN:—Understanding from your published announcements that you recommend your brake for freight-train use we respectfully invite you to a complete and searching public test of its merits in competition with the *Rote Automatic Brake* This test to be made in so complete and critical a manner as to show all the railroads of the country, as well as the Railroad Commissioners of the various States, which of the two brakes is the one which should be used; for the test will, we are certain, leave no doubt in the minds of any witnessing it.

To insure the proper management of the test we suggest that you choose one person, we another, and these two a third person, all three to be well known as capable and honorable rolling-stock experts, to conduct the test, their expenses to be jointly borne by you and by us.

An invitation to witness the test to be extended to the General Officers of Railroads and all State Railroad Commissioners to the members of the National Car-Builders Association, and to the Railroad and daily press.

The test to be at such time and place as may be mutually agreed upon, but we suggest that the proper place would be on some road having high grades and sharp curves, so that both brakes may have as hard and complete a test as possible. As it is necessary to make the test searching and complete, and as all railroads wish to increase the length of their trains and only wait for a brake which will enable them to do so, we think each train should be made up of 50, 60 or 70 cars, as you may prefer, or, if you think best, of even more cars.

Your company to supply your train and engines, we to supply ours.

The following points, among others, to be considered and reported upon:

Cost of equipping trains.

Simplicity.

Freedom from breakage.

Certainty of action.

Effectiveness.

Cost of maintaining.

"Flatting" of wheels.

Any other points submitted by you or by us in writing to be added to the above.

The brakes or trains are to be tested in every manner and under all conditions which practical railway service may suggest, including yard as well as line service.

Among others the following tests are to be applied to both trains:

1st.—Each train is to be (part of the time) run by engineers and crews who have never operated either brake and who are wholly unfamiliar with them.

2d.—The trains are (part of the time) to be partly made up (as nearly all freights are everywhere) of foreign cars, which have neither your nor our brake on, so that the cars having your break or ours on shall be widely and irregularly separated from each other.

3d.—The locomotives drawing your train and ours to be exchanged, from time to time, and draw each others trains.

4th.—Two locomotives equipped as so many freight engines and tenders are, with hand-brakes instead of steam or air brakes, are to be substituted for the two engines used in the test part of the time. Any brake which will not work properly if this is done, you will admit, can be of little practical value in actual service.

5th.—From time to time each train is to be stopped and foreign cars (not equipped with either your brake or ours) are to be run into it, at irregular intervals, just as actual service requires constantly.

6th.—In the making up of trains, etc., crews are to be exchanged at random, so that the test may fully illustrate the convenience of operating each kind of brake in actual ordinary service.

7th.—Frequent short runs, stops and quick starts are to be made.

8th.—A series of yard tests are to be made, showing the action, convenience, etc., of the two brakes.

We mention a few necessary tests only, and you and we, as well as the test committee, are to add any number of others, it being distinctly understood that if you decline any test proposed by us, or we decline any proposed by you, it shall be condered an explicit and positive admission of inferiority.

This rule must in every case be strictly observed, namely: *Both brakes must be tested in precisely the same manner*, so that there may not only be absolute fairness, but no room for suspicion even of anything else.

You have been in the brake field a long time, have profited justly and largely from the patronage of railroads, and we are sure will welcome this plan for allowing your patrons and the American public to judge for themselves which brake should come into universal use.

Having proper confidence in the merits of your brake we know you will gladly and promptly accept our proposition herein made, as you must feel that the test will be complete.

The railroad public is a very fair-minded, capable body, and will most horoughly appreciate and fully recognize the equity and fairness of our offer to you, and, in common with business-like people everywhere, will naturally (and, we are sure you will admit, properly) consider it a virtual confession of inferiority and a public admission that the Westinghouse Brake is inferior to the Rote Brake and that it is unfitted for general freight service, should you decline or neglect to avail yourselves of the proposition we make you herein.

Permit us to add in closing that we wish to express to you our desire to have this communication received in the spirit in which it is sent, and to have it express to you our wish for a full, fair and searching test of the two articles in the relative merits of which the railroad interest is *primary* and that of the owners even secondary. Respectfully,

THE ROTE AUTOMATIC BRAKE COMPANY,

Per M. D. HARTER, President.

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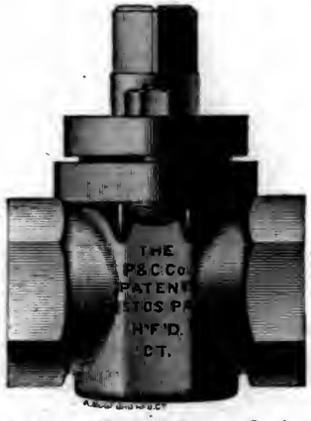

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The Scientific Portable Forges.

American Railroad Journal.

WHOLE NO. 2,576.] NEW YORK, MAY, 1886. [VOLUME LX.—No. 2.

SPLICED SILLS.

BY WM. E. PARTRIDGE.

[Written for the AMERICAN RAILROAD JOURNAL.]

IN your April number Mr. E. P. Williams, in writing of various matters connected with railways, speaks of the evils of spliced sills for passenger-cars. This subject deserves a thorough ventilation, and it was desirable to have your correspondent go still further into the merits of the case. In the east splicing is by general consent condemned, and even in repairs splices are only put in under protest. The master car-builders' rules permit splices only outside the bolsters. In the west less attention seems to be paid to the subject, and in new work spliced sills are no unusual thing. In at least one large shop passenger-cars of all kinds have been turned out with sills in two and even three pieces. These cars are notoriously weak, and break up and are disabled by the failure of the splices, upon the most trivial accidents. There are a large number of these cars in use, and the traveling public are endangered by them.

In the construction of a splice the master car-builders recommend what they term a "ship splice." It is made 24 inches long, has three ⅝-inch bolts through it, and is cut down at the ends 1¼ inch. This was probably adopted because some of the authorities on carpentry hold that a stick thus spliced is weakened to the extent of only one-tenth of the whole strength of a solid stick having the same dimensions. This may be true in regard to a stick used for a bridge or roof chord. A car sill is subjected to very different strains from any similar member in a bridge or a roof. It has to sustain severe strains of compression, to resist which the "ship splice" presents a depth of but 2½ inches where end timber has a fair bearing. The long scarf by a blow tends to wedge open and has only the resistance which the washers and nuts on the bolts present to being drawn into the wood. This is very small, as we know from experience with check chains. The weight of a truck is often sufficient to draw a large washer, nut and all, down through a sill. To a side blow such a splice really presents no resistance worth mentioning. The whole joint depends on the stiffness of two of these bolts, and the resistance of the sticks to splitting.

These splices, as frequently made in western contract shops, have large recesses cut out to take nuts and washers of cross-rods, and in at least one place the nuts and washers on top of the splice are let in flush with the surface. When the area of these openings is taken out of a sill, which is but 8 inches deep in a 54-foot car, very little strength will be found to remain. This construction has frequently been employed on parlor-cars, and even sleeping-coaches have been turned out with similarly defective floor-framing. Such work is little less than criminal.

The following extract from a personal letter from a superintendent of motive-power, who has had long experience and is held in high esteem for his sound mechanical judgment, expresses not only individual but general opinion on the subject. "I am very much opposed to the use of spliced sills under passenger equipment cars. The fact that in *slight accidents these splices give way first* is sufficient indication that they are the weakest point in the sill. In making long freight-cars (say 50 or 60 feet in length, if there were any such) there might be a question of economy in first cost, which would come in to justify the use of spliced sills, but in building passenger-cars we are under a *moral obligation* to study safety and efficiency, rather than economy in the first cost. Therefore, I do not think that the use of spliced sills under passenger equipment cars will be justified." The italics are ours. He then proceeds to cite chapter and verse showing how cars with spliced sills had failed in practice, and it had been found necessary to alter the construction entirely in order to make them safe.

In passenger construction safety is a prime requisite, to which everything else must be subsidiary. To allow a consideration of expense to influence the framing of a passenger-car in such an important essential as the sills is a great wrong, against which every car-builder should use his utmost influence. If long timbers cannot be obtained, the method of framing or the materials must be changed so that the car may not be in any way weakened.

A passenger-car floor might be constructed in such a way that short timbers could be used, and the joints or splices have as much or more strength than a full length timber of the same dimension. Such a construction would call for a radical change in design. The workmanship would have to be first-class in every particular. This, however, would not probably suit the advocates of spliced timbers, because the cost would be large.

STATION DECORATION.

BY MARVIN C. WILLIAMS.

[Written for the AMERICAN RAILROAD JOURNAL.]

THERE are few features of railway construction more apt to attract favorable notice and add to the general reputation of a line than neat and pretty stations, with well-kept approaches. The appearance of a station is about the first point of a railway to catch the eye of the passenger, as no matter how admirable the condition of the line and well appointed the rolling-stock, before the patron of the road has the opportunity to notice and appreciate either, his first impressions are formed from the station and surroundings from which he takes his train.

This is especially true of the more rural towns and

villages, where the station is apt to be more or less isolated, and consequently readily attracts favorable or the reverse notice from that fact, while under these conditions it is easier for a company to present an attractive appearance as it is aided generally by rural surroundings, while land not being so valuable, space is much less of a consideration than in more crowded localities, thus presenting much wider opportunities for taking advantage of those conditions in laying out the surrounding ground with some eye to taste and effect.

It is by no means necessary that the difference in cost between neat and attractive stations and their opposite should be great. The mere question of an expensive building does not so much enter into the question. The great point to be attained is that most effective and charming quality of neatness. Even where the station itself is little better than a shed, and it is undesirable to expend anything on a new building, surprising results may be and frequently are attained at a trifling cost. If the building be tastefully painted, and platforms and approaches kept in good repair, a few flowers well disposed, with close-clipped grass, will work a marvelous change at a very small expense. Nothing has so dismal an effect on the mind as an appearance of neglect. No matter how evidently great the original cost, it is completely sacrificed and lost sight of, if surrounded by a general air of desolation; while on the other hand a fresh coat of paint, a few carefully tended flower-beds, with roads and paths kept neat and clear, give that priceless air of *neatness;* and for a comparative trifle transform a dismal, unsightly and depressing shed into a really charming spot, where to be compelled to wait for a delayed train is transposed from pain to pleasure.

No one who has traveled on the English lines especially has not been struck with admiration at the beauty of the rural stations, and with good reason. A more painful contrast would be difficult to conceive than that between one of these and such as may be met with almost anywhere on our roads. There are, it is true, some notable exceptions which stand out brightly by comparison, and it is probable that their laudable efforts toward reform are fully appreciated and commented on by every passenger under whose eye they pass.

It is doubtful if there be any method for attracting favorable public notice to a railway, more effective, and giving a better return for the outlay than this. It is never wasted, for all see and appreciate, as it requires no special knowledge, but at once appeals to every one; and if companies fully knew how great an influence the question of station decoration has on the traveling mind, there would be a marvelous and mighty change.

BUYING OR BUILDING CARS.

BY E. P. WILLIAMS.

[Written for the AMERICAN RAILROAD JOURNAL.]

IT is little wonder that so many of your readers are puzzled in regard to the question of buying or building freight-cars. The question is by no means settled, and never will be. No general answer will be correct for all roads, yet a few words of advice should enable any manager to reach a conclusion without delay.

On say almost any of our eastern roads the shops are becoming crowded, and few of them are suitable for building without a considerable outlay for machinery and yard-room. In order to build cheaply one must have good machinery of late patterns, plenty of room, and lastly, must build steadily and not spasmodically. Where a superintendent crowds his car-shops with work for three or four months, and then lets them do repairs only for eight or ten, cheap construction is out of the question. The fault is not with the car-builders, who, as a rule, very are competent men, but with the system. Granting that the road has not face enough to build continuously, the answer to the question is, get contract work.

In doing this, select a good car as a standard; not one built by some great road, but one which wears well, preferably one having only a single brace from door to bolster. Have weights cut down when it is possible, and add strength to the draw-gear. The Baltimore and Ohio road will give some hints in this matter. When the best car for service on the road has been found, have an iron-clad contract drawn up, covering every detail. If good, honest work is wanted, let the car-builder put the contract in his pocket and go to some good firm, and after going over it item by item, and getting a close bid from them, have them sign and go ahead. If it is necessary to get a number of bids, be sure that the award goes to one of the highest bidders. If some check is needed cut the order in two and give a part to different firms, selecting those who do the best work. Then the car-builder should be kept at the works inspecting most of his time.

Cars built in this way cost a little less than though built by the road. As a rule they are quite as good as those which most of the roads in the eastern states can turn out for themselves, with their crowded shops and poor facilities. If too much stress is not laid on details, dry timber can usually be obtained without much extra cost. The last advice, but the most important, which can be given in regard to buying cars is, if a good car is wanted, don't peddle a contract about for the lowest bidder.

On most roads having one set of fairly well-appointed shops, figures seem to show that when proper preparations have been made in advance, the passenger-cars can be built each year for less money than the same quality will cost by contract. To do this requires forethought, not on the part of the car-builder, but of the superintendent or general manager.

Unless the shops are unusually well provided with tools and have ample room, it is not wise to attempt more than one car per month. To rush the work means an increase in cost and a decrease in quality; and if more than ten or twelve cars are wanted in a year, the surplus should be obtained from some firm having an established reputation. Chair cars may be built as well as day coaches, but if very handsome cars are wanted, get them outside the shops. The cost of the decoration will more than counterbalance any saving in construction. There are not more than two roads in New England that have the facilities for finishing and decorating a fine passenger or drawing-room car. While the roads have good men, they cannot keep abreast with the fashion. The roads do not have the appliances for making the artistic work required, and are charged high prices in the shops when they have designs made to order.

In ordering passenger-cars the best policy is to specify the standard frame of the car, and then see that the blocking and finishing are as light as possible. With the contract car care must be taken by the inspector to keep useless lumber out. Finally, the outside should be finished with the well-known "Kirby truss," which ought to be held in place with canvas inside, "turned up on to posts and rails," and put on with fish-glue. Trivial points, perhaps, but the canvas is equal to another thickness of wood, and the use of a glue that remains liquid at a low heat insures the union of the canvas with the wood. Such a car wall is practically one piece of wood.

The practical criticism on most of the eastern and many of the western car-shops is about as follows: Passenger-car repairs fairly well done, though slow. The paint-shop, a lazy man's delight, where the man in charge should be told to skip and the department placed in charge of the master car-builder, with orders to reorganize on a business basis. Men will take 100 hours to burn off a car which can be done in 26. On some roads a reorganization of the paint-shop will be equivalent to an enlargement, and many roads now crowded in this department are less in want of room than reformation.

THE HEATER QUESTION.

BY MARTIN W. CROSS.

[Written for the AMERICAN RAILROAD JOURNAL.]

THE recent shocking accident on the Fitchburgh Railway in Massachusetts again and naturally opens up the discussion of mode and means for heating railway-cars. In the Fitchburgh instance a train becomes derailed, and topples over, falling to the bottom of a two-hundred foot embankment. A dreadful accident, and awful in its consequences resulting from the bare derailment and frightful fall, but when to this is added the most dreadful of all forms of violent death—that by fire—the horror is vastly increased.

It appears from all reports that the ill-fated train was at the time of accident entering upon a high embankment, at the foot of which flowed the Deerfield river. For some days previous heavy rain-storms had fallen, with the result of rendering the road-bed unstable and liable to give way. Just as the train reached about the center of the section, the engineer felt the track sink ominously beneath him. He stuck bravely to his post, applied the air-brakes, and did what he could to avert the disaster. but uselessly. The greater portion of the train plunged two hundred feet over rocks and boulders into the Deerfield river, at a shocking cost of life and limb.

The results of such an accident must be and were most shocking, but had the death and maiming been only that directly resulting from the primary cause, it might perhaps fairly be considered as an unforeseen misfortune, for the prevention of which all reasonable care had been used; but this, however, was not the case. No sooner had the cars reached the water than the burning contents of the heaters, scattered right and left by the fall, kindled the shattered and splintered train, making a funeral pyre for those who otherwise would have been rescued from the timbers that pinned them down, with perhaps a no worse result than an exercise of patience, and a few slight bruises.

This last and most horrible feature of the accident was wholly preventable. The present coal-stove heater system for railway cars, continually presents to passengers the awful possibility of a living cremation. It requires but a very small shock to loosen the heaters from their fastenings, and spread a fiery death around. Any accident sufficiently serious to so shatter the cars as to imprison the passenger under broken seats and timbers, is certain to break the heaters from their places, and cause a conflagration that is sure not only to sacrifice the lives of those unfortunates who are pinned to the ground by the wreck, but prevents those, who would otherwise be able to give their help and assistance, from approaching the blazing wreck; and compels them to stand helpless witnesses of their fellow-beings torture.

It would certainly seem as though this feature of risk in railway travel might be eliminated. The system of heating cars by steam from the locomotive has been successfully tried, and unless there be some insuperable reason to the contrary, its general adoption appears more than justified. The question of expense should have no part in such a question. It is certain that lives of human beings have been sacrificed through the use of the present system, which in conjunction with the possibility of a different plan of heating, that would be without this dreadful risk, is an amply sufficient argument against its further use. Figures shows that many a life has been sacrificed from this one and distinct cause. This is quite enough to raise the question if it be preventable; and should investigation prove it so to be, a change should be demanded.

Americans complain of freezing in the trains of Europe in winter travel; but it may be questioned whether a little temporary discomfort be not better than the possible and unexpected death by fire.

THE PERFECT RAIL.

BY R. S. BEVIER.

[Written for the AMERICAN RAILROAD JOURNAL.]

BEFORE steam was adopted as a motive-power, and in some instances afterwards, wooden rails were used for the track. The weight of the new-fashioned motors necessitated a more enduring track and iron straps were nailed down on the stringers. These straps were soon found insufficient as they were easily bent, the ends came loose and sticking up were liable to be caught on the upper side of the wheels and produce disastrous results in the car above as "snake-heads.

This was remedied by increasing the thickness of the bar of iron until it became a square, and the cost of such rails, it was feared by the wiseacres, would be a serious drawback to the future growth of the railway system. In order to lessen this cost the sides of the rails were hollowed out until the upper part on which the wheel ran and the lower part which rested on the ties were connected by a thin "web" only. This is now known as the "T" rail, is the latest improvement, and has been in use for an ordinary lifetime.

During all this time and in all phases of railway invention and construction, a serious difficulty has intervened which it seemed impossible to avoid. The joints between

the ends of the rails constituted an element of inherent weakness. A large proportion of the wear and tear to the rolling-stock, and more than one-half of the accidents and disasters are attributable to this cause. Leaving out the damage done to brakemen in coupling freight-cars the latter assertion is undoubtedly correct. This inherent weakness has always been acknowledged and has been sought to be avoided by numerous inventions. Chairs, fish-joints and splicing in many forms have all been tried in vain.

A quarter of a century has witnessed vast improvements in superstructive roadway, engines and cars, but none in the track upon which the safety of all depends. The latter is like an articulated animal, full of joints and weakness. Upon a new road the depression at every joint causes the engine to sway from side to side, and reel and wrench like a ship in a storm, and on the best roads in the country the passenger, if he can count fast enough and knows the length of the rails, will be able to compute the speed by the hammering and pounding of the wheels on the end of every rail.

To diminish this danger as far as possible the rails have been doubled and in some instances quadrupled in length, but the contraction and expansion of the metal, caused by the changes of the weather, limit the length that is available. The same reason prevents the only perfect rail from being made; one welded solid from end to end of the road. If this is ever done it must be with some other metal than iron or steel.

Granted, a road-bed and superstructure that will give an even and uniform support, and this is one of the simplest problems in railway construction although sometimes difficult to attain. To make a perfect track, or as perfect as the metal will permit, the rails must be as rigid and well supported at the joints as in the center. This is the very problem that it has been found so difficult to solve.

ARBITRATION BY NATIONAL LAW.

THE following bill has been passed by the lower House of Congress, has been promptly taken up by the Senate and will doubtless soon be a law:

SEC. 1. That whenever differences or controversies arise between railroad companies engaged in the transportation of property or passengers between two or more States of the United States, between a Territory and State within the territory of the United States, or within the District of Columbia, and the employés of said railroad companies, which difference or controversies may hinder, impede, obstruct, interrupt or affect such transportation of property or passengers, if, upon the written proposition of either party to submit their differences to arbitration, the other party shall accept the proposition, then, and in such event, the railroad company is hereby authorized to select and appoint one person, and such employé or employés, as the case may be, to select and appoint another person, and the two persons thus selected and appointed to select a third person, all three of whom shall be citizens of the United States, and wholly impartial and disinterested in respect to such differences or controversies; and the three persons thus selected and appointed shall be, and they are hereby created and constituted a Board of Arbitration, with the duties, powers and privileges hereinafter set forth.

SEC. 2. That the Board of Arbitration provided for in the First Section of this act shall possess all the powers and authority in respect to administering oaths, subpœnaing witnesses and compelling their attendance, preserving order during the sittings of the board, and requiring the production of papers and writings relating alone to the subject under investigation, now possessed or belonging to the United States Commissioners appointed by the Circuit Court of the United States; but in no case shall any witness be compelled to disclose the secrets or produce the records or proceedings of any labor organization of which he may be an officer or member; and said Board of Arbitration may appoint a clerk and employ a stenographer, and prescribe all reasonable rules and regulations, not inconsistent with the provisions of this act, looking to the speedy advancement of the differences and controversies submitted to it to a conclusion and determination. Each of said arbitrators shall take an oath to honestly, fairly and faithfully perform his duties, and that he is not personally interested in the subject matter in controversy, which oath may be administered by any State or Territorial officer authorized to administer oaths. The third person so selected and appointed as aforesaid shall be the president of said board, and any order, finding, conclusion or award made by a majority of such arbitrators shall be of the same force and effect as if all three of such arbitrators concurred therein or united in making the same.

SEC. 3. That it shall be the duty of said Board of Arbitration, immediately upon their selection, to organize at the nearest practicable point to the place of the origin of the difficulty or controversy, and to hear and determine the matters of difference, which may be submitted to them in writing by all the parties, giving them a full opportunity to be heard on oath, in person and by witnesses, and also granting them the right to be represented by counsel; and after concluding its investigation said Board shall publicly announce its award, which, with the findings of fact upon which it is based, shall be reduced to writing and signed by the arbitrators concurring therein, and, together with the testimony taken in the case, shall be filed with the Commissioner of Labor of the United States, who shall make such award public as soon as the same shall have been received by him.

SEC. 4. That it shall be the right of any employés engaged in the controversy to appoint by designation in writing one or more persons to act for them in the selection of an arbitrator to represent them upon the Board of Arbitration.

SEC. 5. That each member of said tribunal of arbitration shall receive a compensation of $10 a day for the time actually engaged. That the clerks appointed by said tribunal shall receive the same fees and compensation as clerks of the United States Circuit Courts and District Courts receive for like services. That the stenographer shall receive as full compensation for his services 20 cents for each folio of 100 words of testimony taken and reduced to writing before said arbitration. That United States Marshals or other persons serving the processes of said tribunal, shall receive the same fees and compensation for such services as they receive for like services upon

processes issued by United States Commissioners. That witnesses attending before said tribunal of arbitration, shall receive the same fees as witnesses attending before United States Commissioners. That all of said fees and compensations shall be payable by the United States in like manner as fees and compensations are payable in criminal causes under existing laws; provided that the said tribunal of arbitration shall have power to limit the number of witnesses in each case where fees shall be paid by the United States; and provided further, that the fees and compensation of the arbitrators, clerks, stenographers, marshals and others, for service of process, and witnesses under this act shall be examined and certified by the United States District Judge of the district in which the arbitration is held before they are presented to the officers of the Treasury Department for settlement, and shall then be subject to the provisions of Section 846 of the Revised Statutes of the United States, and a sufficient sum of money to pay all expenses under this act and to carry the same into effect is hereby appropriated out of any money in the Treasury not otherwise appropriated; provided, however, that not exceeding $1,000 shall be paid out of the Treasury of the United States to defray the expenses of any single arbitration under this act.

Locomotive Boiler Explosions.

No class of steam boilers largely used in America is so free from disastrous explosions as those used on our railroad locomotives, which is something remarkable in the presence of the fact that few boilers are run with a smaller safe margin of strength. Within the last few months there have been several locomotive boiler explosions that direct our attention to the subject, and we are the more disposed to discuss it, since attempts have been made to attribute one of the explosions to some mysterious cause beyond human comprehension. When a boiler explodes under a pressure which had often been carried before without signs of weakness, certain parties are sure to proclaim that some mysterious agency has been at work. In other departments of mechanical engineering, similar phenomena are of daily occurrence and pass without comment. A link in the chain of a crane breaks under a lighter load than the chain lifted two hours before, a crank-axle breaks, not when the engine is working at its maximum power, but under comparatively light duty, a locomotive axle breaks when the engine is jogging along at a quarter the speed it made the day before. Every intelligent engineer meets incidents of this kind every month, and knows how to account for the occurrence. The same laws apply to the rupture of steam boilers that control the safety of a chain link, yet the men who readily perceive a rational cause for a chain breaking to-day under a lighter load than it carried yesterday, fail to account in a natural way for a boiler exploding under ordinary working pressure and without warning.

No subject connected with the locomotive has received more attention from the Railway Master Mechanics' Association than the cause of boiler explosions, and the deliberate conclusion reached after years of patient investigation was, that ordinary over-pressure alone caused boilers to explode. A boiler works along safely for months or years after being built or thoroughly repaired, and some deteriorating agent keeps operating upon it unnoticed till a weak link in the shape of a corroded sheet or some broken stay-bolts gives way, and the boiler goes to pieces.

It is satisfactory to notice that the labors of the various master mechanics' committees on boilers appear to have produced good results; for although the number of locomotives in the United States has been increased materially since 1875, the number of boiler explosions reported has been greatly diminished. During the year 1875, there were reports made of 16 violent explosions of locomotive boilers, and in 1885 the number reported was 11. This gratifying improvement is, no doubt, due to greater care and skill in designing, to better material used in construction, to more careful workmanship, and to the growing practice of rigid tests and searching inspection. This has been the line of policy advocated by the Master Mechanics' Association as the proper means for making locomotive boilers as safe as human agency can make a vessel containing the potential destructive agencies inside a high-pressure boiler, and the men who enforce this policy in their daily practice are the men who secure immunity from accidents. The safety of locomotive boilers, even those that have been well made of proper material, is secured only by the constant care and unremitting vigilance that will be sufficient to guard against and detect in time, deteriorating influences. When these are relaxed for any length of time, disaster is inevitable.—*National Car-Builder.*

How to "Kill" Engines.

"TELL me how St. Louis strikers 'kill' so many engines, and render them useless for service, will you?" asked a reporter for the Denver *Tribune* of an engineer who was busy oiling the links of his engine in one of the local round-house yards.

The runner looked over his questioner and asked: "Are you a reporter?"

"Yes, sir."

"Then I have nothing to say. Besides, I am too busy now to talk anyhow. Catch on to some one else."

The questioner found some one else in the "barn" whom he knew, and who would talk.

"How they 'kill' engines, hey? Well, the quickest and surest way is to take this away," the runner replied, laying his hand on the throttle-lever. "Shut the throttle by pushing in the lever-pin, disconnect the fulcrum connections with the boiler-head, stick the lever under your coat and march off with it, and the engine is useless. Even if she is near the machine-shop it will require a couple of days to replace the lever at a cost of $14, as it must be forged and turned, and the brake throttle ratchet must be cast, filed and polished. That is much better than to carry off connecting-rods, as I saw represented recently in an illustrated paper. It would take two men, at least, to cart away one connecting-rod, which, you know, connects the crank-pin of the forward driver with the cross-head, though that disables a locomotive, of course."

"Several Vandalia trains were 'killed' by the water-gauges being knocked off, so the despatches said."

"If that is all the despatches said, they didn't cover all

the ground, because the water-glasses would be left, and an engineer can run without the one if he has the other. If the gauges are knocked out, the holes can be readily plugged up, and new gauges only cost seventy-five cents each. But if gauges and the water-glass with its fillings are bursted, the engine is no good.

"Any attempt to run will end in burning her flues and crown-sheet. You see where these parts are covered everything is lovely, but with low water they burn out. I've seen a burnt crown-sheet dropped down from its braces almost into the grate. An explosion occurs at such times, which tears everything to pieces. But then the strikers on the Gould system have burned no engines, and any parts they have carried off will turn up all right after the strike."

"Are there other parts of the machinery that can be taken away to 'kill' a locomotive?"

"Oh, my, yes. Take down the eccentric links or take off the valve-stems, and your engine is dead. The favorite way, when an engine is on the road, is to put out the fire, open the blow-off cock, which you see standing out from the side of the fire-box under the cab, and let out all the water. Then the engine must be hauled to the nearest tank and filled up before she can be fired up.

"As for 'killing' engines in the round-houses, the strikers remove such of the parts I have mentioned as will require the longest time to replace, and very likely at the same time let the water all out of the boilers."

A New Locomotive.

THE "New Atlanta Locomotive" is thus described: "All of the machinery is simply a rotary engine attached to the driving shaft, or two or more rotary engines can be attached to the different driving shafts, in case great power is required. The entire working machinery usually on a locomotive is dispensed with—cylinders, steam-chests, pistons, cross-heads, rods, balance weights, cranks, etc., all set aside, and the simple locomotive stands out bereft of a third of its expense of manufacture and four-fifths of the expense for repairs. It is claimed that this locomotive, because of having no cylinders, cross-heads nor rods—requiring no balance weights—will run much steadier and smoother than the locomotive now in use. There being no cranks, steam having the same purchase at any position of the driving-wheels, there are no dead centers and the steam has an application of uniform power at all times and in all positions of the driving-wheels. It is claimed that it is capable of great speed, and this the inventor, Mr. W. C. Shearer, had mainly in view in working out his idea. He feels certain that he can shoot along with an ordinary passenger-train at the rate of seventy or eighty miles an hour; in fact, with as great speed as the rolling-stock and track will stand. The rotary engine is attached to the driving-shaft and locomotive frame in an ingenious manner, providing for any change of position caused by rough road and play of the springs. There are two steam ports into the rotary engine—one for going ahead and the other for backing. When one port is giving steam the other exhausts, which is utilized for draft. Steam is taken from the dome, and admitted, shut off, quantity regulated, etc., by a lever in the cab, similar to the reverse lever of an ordinary locomotive. A steam-valve at the dome, regulated by a rod from the cab, instantly shuts off the steam-pipe. The motion of the rotary engine and drivers can be reversed instantly by the reverse-lever in the cab."

Dangerous Feed-Waters.

IN a recent issue the *Railway Reporter* says: "Feed-water heavily charged with lime salts has been doing a great deal of damage to locomotives traversing countries where pure water is not easily obtainable. The formation of scale results, against which there is no sufficient protection. Fire-boxes are frequently worn out with a mileage less than 100,000 miles, and tubes are removed every few months. Some waters are strongly corrosive and destroy boilers and fire-boxes. The doctoring of water with chemicals has been tried and failed. Railway managers find it cheaper to renew fire-boxes and tubes.

The best device for separating the lime from the water has been introduced by S. J. Hayes, of the Illinois Central Railroad. The locomotive on which the device was used had two domes. The forward one was a purifier and was filled to the ring with scrap-iron, supported on a grating, placed at the bottom. The scrap retained a considerable portion of the lime salts that entered, and was frequently removed and cleaned. On the far western roads analysis shows that well water varies from 11 grains to 140 grains of solid matter to the gallon. No very practical device has yet been brought out to overcome this impurity, but attention is being given to it, and, no doubt, some means will be established by which the loss and cost can be avoided.

The Lake Shore has kept a record of the mileage of each car-wheel in the freight service on its road for years. This method of bookkeeping is not practicable, however, with wheels under cars that run for long distances on their roads. Car-builders would be glad to establish some system by which a record of each individual wheel could be kept, but this is practically impossible.

Why the Middle of a Car is Preferable.

THE *Railway World* says: "A very common theme of conversation among travelers is the question of whether or not a car rides easier in the middle than above the trucks. One of our railroad contemporaries some time ago published an article on the subject, and took the ground that there could be no difference unless the sills and framing of a car yielded like the buck-board of a wagon. There is certainly no yield to car sills and framing, yet every old traveler avoids the seats, and especially the sleeping-berths, above the trucks, and old travelers generally know what they are doing. If the party who insisted that there could be no difference in the motion in different parts of the same car, had ever crossed the stormy ocean in a moderately long steamer, he might have received some enlightenment, especially if sea-sickness urged him to find the point of least motion. It is well known that there is less motion amidships than there is at the stem or stern, and less motion at the bottom of the vessel than there is on deck. A car acts in a similar way. Anything defective about the track jerks the wheels, which transmit the irregular motion to the truck, and that in turn

gives it to the car. The point above the truck receives the concussion direct and is forced upward, causing a jar on settling back. This jar is scarcely felt at the other end of the car, and has not more than half the intensity in the middle of the car. The consequence is, that the seats toward the middle of a car are on the neutral point where the jerks transmitted from the trucks are reduced to a comfortable limit. This is why riding in the middle of a car is, as a rule, not only safer than the ends, but more comfortable as well."

The German Patent Law.

COMMERCIAL AGENT SMITH, at Mayence, writes to the State Department at Washington as follows:

"The workings of the German patent law are not at all satisfactory or conducive to the interests of American patentees. The statute is very explicit in its provisions, and American inventors and patentees have the right, if they comply with its terms, to ask that the law be carried out; but I am sorry to say that it is almost impossible to get infringement punished, or even taken notice of. The law provides that the district-attorney where the infringer resides shall criminally prosecute on information furnished, but as patents and patent-rights are surrounded by a multitude of technicalities, the district-attorney almost invariably refuses to proceed, or pigeon-holes the complaint. The lawyers say that he is obliged to carry out the provisions of the statute, but the general experience of patentees is that he does not do so; hence the infringer is bold and openly defies the law, and the public conclude that the law can be broken with impunity."

A Honduras Railway.

ACCORDING to the *Chicago Times* there is only one railroad in Honduras, but that is worthy of a description:

"It extends from Purto Dortes, on the north coast, to San Pedro Sula, some thirty-five miles from the sea. The track is in barely passable condition. In places there are few ties, and in others there are none. Indeed, I was assured by a man who says he has charge of a section eighteen miles long, and of no laborers to help keep it in order, that in one or two places the rails are held in their places by wooden pegs and nothing else. Of course this must be true, for he told it, but I did not see the pegs. But it was easy to see where the rails have worked their way down into the gravel road-bed until the iron can no longer be seen, and the car-trucks scrape the top off the ballast as they pass. Grass grows high over all the right-of-way, the dew it bears wetting engine and cars as they drag along. Bamboo, the fronds of palm trees, bushes, shrubs and vines brush top and sides of the passing train. (Don't make the word 'trains,' for there is in the equipment of the road only enough rolling-stock for one train of some five or six cars.)

"On the bridges, of which there are many small ones, there are no ties. The rails rest uneasily upon heavy and more than half-rotten stringers. The one engine on the road is made up of parts of four, of ancient English pattern, brought here some fifteen years ago, when this road began. The passenger-coach—in the singular number—is about as large as an average street-car, but differs materially from it in style and finish. All of the frame above the floor of the car is of wood, dingy with age, smoke, and grime worked in by the pressure of the sweating hands of hundreds of passengers, who religiously believe that to work the hands is folly, and to wash the face after 4 o'clock in the afternoon is death. As the rickety, panting engine rocks along over the hummocks of the track the frame of the coach sways easily from side to side as a loose-jointed basket worn by hard, long usage may be pushed out of shape. The top is double-decked, because a multitude of holes were burned deep into the original roof by the streams of burning sparks spouted out by the engine.

"The marvel is that freight and passengers can be hauled over the road without dumping the whole cargo into the ditch a dozen times each trip; but, some way or other, by the lavish expenditure of energy and ingenuity—about all the capital he had to expend upon it—Gen. Krafft has managed to keep the train moving. Fruits form the principal freight coastward, and merchandise from foreign lands, that which goes to San Pedro. The capacity of the road is taxed heavily, although rates are almost prohibitory. What might be done by a well built, properly equipped, and well managed road reaching from ocean to ocean, across this country of precious metals, valuable fancy woods, prolific fruit plantations, and shortening by hundreds of miles the route from the east to the west, may easily be guessed."

Fractures in Iron.

HUNDREDS of existing railway bridges which carry twenty trains a day with perfect safety, would break down quickly under twenty trains per hour. This fact was forced on my attention nearly twenty years ago, by the fracture of a number of iron girders of ordinary strength, under a five-minute train service. Similarly, when in New York last year, I noticed, in the case of some hundreds of girders on the elevated railway, that the alternate thrust and pull on the central diagonals, from trains passing every two or three minutes, had developed weaknesses which necessitated the bars being replaced by stronger ones after very short service. Somewhat the same thing had to be done recently with a bridge over the river Trent, but the train service being small, the life of the bars was measured by years instead of months. If ships were always among great waves, the number going to the bottom would be largely increased. It appears natural enough to every one that a piece even of the toughest wire should be quickly broken if bent backward and forward to a sharp angle; but perhaps only to locomotive and marine engineers does it appear equally natural that the same result would follow in time if the bending were so small as to be quite imperceptible to the eye. A locomotive crank-axle bends but $\frac{1}{84}$ inch, and a straight driving-axle a still smaller amount, under the heaviest bending stresses to which they are subject, and yet their life is limited. During the year 1883 one iron axle in fifty broke in running, and one in fifteen was renewed in consequence of defects. Taking iron and steel axles together, the number then in use on the railways of the United Kingdom was 14,848, and of these 911 required renewal during

the year. Similarly, during the past three years no less than 228 ocean steamers were disabled by broken shafts, the average safe life of which is said to be about three or four years. Experience has proven that a very moderate stress, alternating from tension to compression, if repeated about 100,000,000 times, will cause fracture as surely as a bending to an angle repeated only ten times.

A Mammoth Passenger-Station.

THE Waterloo railway-station at London, has been opened for traffic by the utilization of the several new lines and platforms which have for some time past been in course of construction on the north side, and this station is now said to be the largest passenger terminus in the metropolis, covering an area of upwards of 20 acres, and extending southwards from Waterloo road to Westminster Bridge road. Owing to the continued increase of railway traffic the enlargement of the station has been in progress during the last four or five years. What is designated the new station, on the south side of the old main line station, was completed about two years since, and did much to relieve the pressure caused by the great suburban traffic on the company's several loop-lines branching off from the main line, but this increased accommodation was found inadequate to the traffic demands made upon the company, and hence the further enlargement on the north side in the direction of York road, which has just been completed. It contains four additional double lines of rails and five new platforms. The station as now enlarged contains a total of 16 platforms, and 19 lines of rails, having an aggregate length of more than four miles. A special feature in the arrangements of the station is the signal-box at the entrance, which is said to be the largest in England, containing no less than 180 levers. Including the purchase of houses, lands and compensation, the estimated entire cost of the station is said to be £350,000.

Paper Rails in Russia.

IN the *Gentlemen's Magazine*, and regarding the projected establishment of works near St. Petersburg for the manufacture of paper rails, Professor Mettieu Williams says: "We are told by the *Organ des Mines* that these can be produced at one-third the cost of steel rails, and that they are extremely durable, the paper being condensed by great pressure. Being much lighter than metal, these rails may be carried and laid at far less cost. They are to be made in greater lengths than ordinary rails, and, therefore, will have fewer joints. This will doubtless diminish oscillation and the consequent wear and tear of rolling-stock. The success or failure of the project is simply a question of durability, and I doubt whether any body can make any prediction better than mere random guessing concerning this. Many will, of course, laugh at the idea as obviously absurd, but all great innovations are obviously absurd to those who do not understand them. In reference to this we must remember that much of the wear and tear of our rails is due to the crushing weight of the engine, and this can not be diminished with metal rails, for if the engines were made lighter the grip of the driving-wheels would fail. The paper will doubtless afford a far better adhesion, and thus be less violently treated, and effect a saving in the plant. It is not a question of wear, but of crushing. When there is no slipping of driving-wheels, nothing but rolling pressure, there can be little or no wear of surface. The only doubtful question, as it appears to me, is whether the compressed paper will disintegrate internally under the action of repeated crushing strain, and thus bulge out sidewise. The tenacity of paper is much greater than is commonly supposed. The prevailing ideas on the subject are due to the fact that we usually have it before us in films that are easily torn by a cross strain. A sheet of iron equally thin is similarly tearable. If we try to break a piece of paper by a fair, straight pull, its great tenacity becomes evident. Count Rumford made a bar of paper by gluing strips of ordinary sheets together. He found that such a bar having a sectional area of one square inch sustained a weight of fifteen tons. This is a near approach to the tenacity of wrought iron. The admiralty test for ship-plates is twenty-two tons in the directions of fiber, and eighteen tons across for first-class, and twenty and seventeen tons for second-class iron. We must all be well-wishers for the success of this invention, as the luxury of gliding over noiseless tracks would be charming. Even our iron masters would scarcely complain, the rail-making trade having been long since reduced to a series of transactions about as profitable as cashing one's neighbor's checks. My own view of the commercial part of the subject is that the superseding of iron and steel rails would be a national blessing. Our supplies of raw material are limited. We are rapidly exhausting our coal, and already have to largely import our iron-stone. The capital now engaged in such crude work as rail-making would be far better employed in higher production. Better that the outside world should make its own rails and come to us for locomotives. An ounce of watch springs or a pound of needles is worth as much as a ton of rails, and with our excess of labor and dearth of material, it is desirable that we should be forced by competition to make up value by highly elaborating small quantities of material."

Ship Railways Again.

THE *Railway Review* says: Congressman Herman, of Oregon, asks the House to instruct the commerce committee to report an appropriation of $1,373,000 for the construction of a ship railway from deep water on the Columbia river at the city of The Dalles to deep water at Celilo, on the same river, in Oregon. Mr. Herman states that the Columbia river drains an area of 245,000 square miles, embracing portions of Oregon, Nevada, Washington, Idaho, Wyoming, Utah and Montana, and exceeding the combined area of the New England and Middle States and Maryland, Virginia and West Virginia, being larger than France or Germany, and twice as large as Great Britain and Ireland; that the surplus wheat of the Columbia basin amounted in 1884 to over 350,000 tons, and that in ten years the exportation of grain alone will probably amount to 25,000,000 bushels. The whole channel of the Columbia river is choked for 13 miles above The Dalles by an accumulation of fixed rock and lava, and to open a channel through or around the obstruction would cost, according to the estimates of United States engineers,

$11,000,000. Major W. A. Jones, United States engineer, estimates that a ship railway 13 miles long to connect continuous navigation 450 miles above and 200 miles below the obstruction would cost $1,373,000. Mr. Herman says as there is some doubt of the practicability of the Eads ship railway across the isthmus it would be well to try the experiment of transporting small vessels by the proposed Columbia river railway before undertaking the transfer of heavier vessels across the isthmus by ship railway.

The Inventor of the Valve Motion.

THE invention of the valve motion to a steam-engine was made by a mere boy. Newcomen's engine was in a very incomplete condition, from the fact there was no way to open and close the valve except by means of levers operated by hand. He set up a large engine at one of the mines, and a boy (Humphrey Potter) was hired to work these levers. Although this is not hard work, yet it required his constant attention. As he was working the levers he saw that parts of the engine moved in the right direction and at the same time he had to open and close the valves.

He procured a strong cord, and made one end fast to the proper part of the engine, and the other end to the valve-lever, and the boy had the satisfaction of seeing the engine move with perfect regularity of motion. A short time after the foreman came around, and saw the boy playing marbles at the door. Looking at the engine, he saw the ingenuity of the boy, and also the advantage of his invention. The idea suggested by the boy's inventive genius was put in a practical form and made the steam-engine an automatically working machine.

A Question of Economy.

IT is a noteworthy fact, says the *Iron Age*, that practices which have long been recognized as prejudicial to economy in stationary engine-running are permitted to continue in locomotive management without apparent cause. Among several, that of throttling the steam supply to the cylinders as a means of regulating the work to be done, calls for increased attention, and might easily be abolished, to the great benefit of the expense account. Automatic cut-off-engines of the present day have conclusively demonstrated what advantages are to be derived from such a cause, and make it appear all the more curious that locomotive engineers as a body have not become impressed with the importance of keeping the throttle wide open, and by regulating the speed by the reverse lever. Instances are not lacking where great differences of fuel consumption in different locomotives were traced directly to the manner of handling the throttle-valve; and cases where especial facilities had been provided for the working of the reverse levers showed that the results were of the most satisfactory character. In the light of such experience it is but reasonable to expect early and decided reform in this direction. Arrangements which would encourage the use of the reverse and the abandonment of the throttle-valve for purposes of regulation would not be difficult to effect, and would soon exert a marked influence on the coal records of the engines.

Another New Rule for Running Railway Curves.

MR. M. J. BUTLER, of Napanee, has forwarded to us another solution to the problem of running railway curves sent us by Mr. Charles Seymour. of Palestine, Ill., and published in the March JOURNAL. Mr. Butler writes as follows:

NAPANEE, April 5th, 1886.

Editor American Railroad Journal:

SIR.—I noticed in your issue of March, 1886, an article from Mr. Charles Seymour, chief engineer, of the Bloomfield Railroad, on a new rule for running railway curves. I used it four years ago in picking up the line of the Thousand Islands Railway. However, I think the solution of the problem is unnecessarily long. By using any of the modern field books, viz: Searles, Henck, or Shunk, a table of external secants for a one degree curve will be found calculated for intersection angles running from 1° to 120°. Now the *modus operandi* I followed was as follows: I produced the tangents to intersection, and measured the deflection angle. I next bisected the interior angle measuring carefully the exterior secant distance. I then looked in my Searles and found the external secant for the given intersection angle, for a one degree curve. I divided my measured distance into this external secant and found the degree of the curve, which would pass through the measured external. I next took from book the tangent for the given curve and planted B. C. and E. C., then run in the curve. An example will best illustrate the ease with which the work is done.

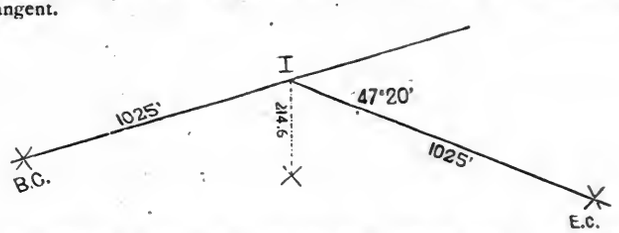
Given I = 47° 20′.

Ex sec measures 214.6 feet.

Searles page 290, ex sec for 1° curve for an angle of 47° 20′ = 526.13.

526.13 ÷ 214.6 = 2° 27′ curve.

Tangent for 1° curve, angle 47° 20′ = 2511.2 ÷ 2° 27′ = 1025 feet for tangent.



The following simple formulæ enables one, in the absense of a modern pocket book, to compute the data, using the natural sines, tangents, etc., as being shorter and better than the logarithmic, sines, tangents, etc.

Tangt. = ex sec x cot. ¼ intersection angle.

Radius = ex sec x cot. ¼ intersection angle ÷ tan ½ intersection angle.

Example same as before.

I = 47° 20′. Ex sec = 214.6

Ex sec 214.6 x not. cot. ¼ 47° 20′ = 4.773

Tangt. of curve = 1024.2858

Radius equals tangt. ÷ Tan ½ I = 1024.28 ÷ .43828 = 2337 ft. 2° 27′ curve

IN the seven years from 1878 to 1885 the railway mileage of Canada increased from 6,864 to 10,149 miles, the train mileage from 19,000,000 to 30,623,000, the total number of passengers carried from 6,443,000 to 9,672,599, and the tons of freight from 7,883,000 to 14,679,000. This shows encouraging growth.

SOME roads have adopted the plan of numbering the berths of sleeping-cars in distinct figures on the outside of the curtains. Passengers speak very highly of the convenience of the practice, and we see no reason why it should not be universally adopted.

THE daily work of locomotive engineers in Germany varies from four to five hours per day for fast-trains to ten hours for freight-trains. The engineers get every fourth, fifth or seventh day for rest. Switchmen have a day off every two weeks.

AN agitation is in progress for the construction of a new line from Atlanta to the seaboard; it will open up a rich country. The line has not been agreed upon, some projectors wanting it to go in one direction, some in another.

American Railroad Journal.

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NEW YORK, MAY, 1886.

Principal Contents of this Number.

CONTRIBUTIONS.

(Written for the American Railroad Journal.)

EDITORIALS.

MISCELLANEOUS AND SELECTED.

STREET-RAILWAYS.

NEW INVENTIONS.

THE CHICAGO SOCIALISTS.

THE recent ebullition of socialism in Chicago should by no means be thoughtlessly confounded with the strikes or even lawlessness of workingmen proper, as the two are quite distinct and separate. The outrages perpetrated by the Chicago "Reds," following closely on the labor excitement, naturally tend to excite public feeling against workingmen's organizations, and the men themselves as a class; but to condemn all together would be manifestly unfair, although to do so in the first flush of irritation is not unnatural.

The scoundrels taking part in the Chicago outrage, though self-styled "workingmen," probably never in a solitary instance did a single stroke of labor, further than when the absolute necessity of lack of means to procure drink compelled a momentary and spasmodic activity. Herein they essentially differ from the workman proper and genuine striker. The latter has of late done much to deservedly forfeit the public sympathy, which was almost invariably his portion; but while misled and in the wrong they are not assassins.

They have, it is true, collectively committed more than one crime which strictly construed would be felonies, but their motive was not simply to overturn society in the hope of profiting from the wreck, but was doubtless in their estimation one eminently proper, and from their standpoint justifiable. Some allowance, therefore, may fairly be made them. At all events they *are* workingmen.

To properly deal with the parties responsible for the bomb-murder in Chicago is a wholly distinct matter. It is gratifying in the extreme to note the activity of the city authorities, and the pleasing prospect of a short shrift for the scoundrels implicated, is most exhilarating in these times of easy escape from the wages of sin, while the spectale of half a dozen "Reds" rotating at rope-ends cannot fail to be of admirable influence on their fellows.

If the example will but serve to convince the foolish and misguided workingman that the law is not to be more safely broken by the mob than by the man, the sad sacrifice of brave lives may not wholly be a loss, and good come out of evil.

ONE WAY OF PROMOTING HARMONY.

IN controversies between railway companies and their employés it is agreed by the reasonable men on both sides that arbitration should first be tried to settle disputes. In this view we fully concur. We are, however, of the opinion that it would be still better to avoid discontent and controversies altogether, and are hopeful that some means might be devised to cultivate such mutual good-will and confidence as to eliminate almost,

if not altogether, any occasion for discontent. Whenever employés are convinced that their employers take a genuine interest in their welfare, and that in the matter of wages they fare as well as the average of their class, they can see clearly enough that interruption of existing relations must be damaging to all concerned; but first and chiefly to themselves.

But conviction on this point is not gained by mere professions. Tangible evidence of a substantial nature admits of no question, and is measured chiefly by the benefits conferred, but partly by the cost to the donor. To the latter, then, the question is, whether the investment brings an adequate return.

There is no dispute that contentment on the part of employés is in the highest degree conducive to orderly conduct, and to faithful and efficient service, and that an assurance of maintaining such a spirit is worth money to a large corporation. It is far better that a measure looking to such an object should originate with the company than with its employés, that it should be freely offered than granted with reluctance or hesitation. At the same time it should not be thrust on them for compulsory acceptance, as such a course would be sure to excite suspicion and provoke opposition. A measure of such nature would go far to prove that a corporation, though not endowed with an individual soul, is yet capable of cherishing human sympathies, and would be reasonably sure to secure an appreciation fruitful of good works.

The casualties of railway duty and the sickness incident to humanity under all circumstances afford abundant occasion for the exercise of friendly offices and for organized provision of relief. The assurance to an employé that he will receive, under such circumstances, skilled medical attention and comforts suited to his needs, is a great encouragement to zealous discharge of duty and to orderly conduct. We are satisfied that no more effectual way could be found to win the gratitude and confidence of men, then an assurance that they will not become common objects of public charity in alms-house or hospital, when overtaken by accident or sickness, but will be entitled to the provision which their thoughtful employers have organized in such fashion that all can contribute and none become objects of charity. Thus men preserve their self-respect, and never take the first downward step which so often leads to settled pauperism.

These thoughts have been suggested by the recent railway labor disturbances in the southwest on the one hand, and by late articles on "Railway Medical Service," published in the JOURNAL, on the other. To illustrate the view here taken, we are permitted to use the following extract from a letter written by the secretary of the Baltimore and Ohio Railroad Employés' Relief Association to the writer of the articles just mentioned:

"Outside of Chicago there is little or no agitation on labor subjects among our people, and there is a very general satisfaction with the relief-plan, which has found high favor with a large majority of our employés. Answering your inquiry as to whether there is any reason to apprehend an extension of the present labor disturbances to the people of our company, I am justified by all attainable testimony in saying that there is no strong ground for such apprehension, and in my judgment the results of our relief-plan will very materially and favorably affect our company's interest in the present troubles."

This is only one of a good many advantages, of a mutual character, accruing from a well-organized railway medical service, but the one just now brought into prominence by disturbances altogether likely to recur, not likely ever to be entirely obviated, but capable, in our judgment, of being greatly moderated and sometimes prevented by the measure indicated.

COMPULSORY INSURANCE.

THE compulsory-insurance idea as formulated by some of the principal railway companies has stirred up so strong an opposition on the part of the employés, that its success is doubtful.

There would seem to be some basis for complaint on the part of the unwilling beneficiaries, if a prospectus issued by one company may be taken as a type of all. The annual contributions or premiums are scaled according to the wages of the policy-holder, but each class pays the same premium, irrespective of the age of the insured at the period of entering. Further, there seems to be no discrimination made as to the employment; an express-engineer, or freight-brakeman paying no more than an entry-clerk in the principal office. It may be true that taking say one thousand employés of different duties the premiums might average about fairly, judged by the ordinary mortality standard; but taken individually the young office-clerk of eighteen would have to pay the same premium for $1,000 insurance, as a coal-car driller of sixty years of age. This works well for the ancient driller, but would hardly be viewed enthusiastically by the youthful clerk.

Even if the premiums were graded according to age, as by the customary system, the young man of twenty would pay much more than the actual cost of his insurance; as by the usual plan, this excess of premium is balanced in later years by a corresponding excess of cost, which strikes an average. In order, however, to preserve this equilibrium it is essential that the insured should remain a permanent member of the organization, or have the option of a surrender value; and as it is quite probable that an employé of a road might change his situation, three main features of an equitable life-insurance would be denied him.

It can not be considered surprising that the scheme is not received with favor by the parties most interested.

EDITORIAL NOTES.

A SHORT time since some English railway authorities reported on our systems that they failed to observe any feature that might be advantageously transplanted to their own in the hope of taking root. It almost seems that "experientia *non* docit," since a recent snow blockade on some of the English lines should at least have demonstrated the utility of our heating facilities; while the absence of drinking water and other very necessary conveniences was, at the time mentioned, severely felt. These perhaps minor points might be worthy of imitation.

* * *

M. ESTRADE, a private French gentleman of fortune, deserves much credit for his pluck and perseverance in demonstrating the utility of his views on tractive power. Failing to procure that hearing and experiment to which he considered his ideas entitled, he has taken the demonstration on himself, and is building a locomotive at his own expense to show that he is in the right. His point lies in that he considers the present diameter of tractive-wheels too small, and he consequently is having constructed, at his private cost, an engine with drivers of 8 feet 2½ inches diam., which he considers will effectually convince all doubters. An inventor of so practical a pluck deserves encouragement.

* * *

THE *Railway Reporter* for April says:

"A steamboat from St. Louis, on a single trip, carried to New Orleans 27,000 tons of grain, the freight upon which amounted to $1,800. It is claimed by those who know, and have made the calculation, that the same amount of freight by rail would have cost $178,000. That its transportation would require 2,700 cars. This is certainly a tremendously strong argument in favor of liberal appropriations for the improvement of our rivers and waterways in the interest of facilitating and perfecting navigation."

This, if true, would indeed be an argument in favor of water-transportation, but the figures are a little startling. First we have a steamboat carrying 27,000 tons of grain alone, while the tonnage of the great ocean liners rarely exceeds 8,000. Further, the freight on one ton of grain from St. Louis to New Orleans appears to be 6.6 cents; certainly a very low figure, against which competition on the part of railway-carriers may indeed be considered hopeless.

* * *

IN the west, at least, the cyclone may fairly be considered to have its bearing on the railway interests. During a wind storm, April 6th, a passenger-train on the Port Huron and Northwestern Narrow-gauge Railroad in Michigan was blown from the track, three coaches being hurled into the ditch and eleven people injured, though only one seriously. Two or three similar occurrences can now be called to mind, in all of which the trains were on narrow-gauge roads. For the section interested, where these violent whirlwinds are common, it may be questioned whether the tornado is not a factor in road-building, since the narraw-gauge lines appear to invariably suffer from their effects.

* * *

THE laws bearing on the responsibility of railway companies for losses in sleeping-cars vary in different States. The question is one which should come under one general decision, that travelers might know what redress to expect, regardless of the consideration of the particular section of the country in which the loss occurred.

* * *

THE first through-train over the Canadian Pacific Railway, between the Atlantic and Pacific oceans, left Montreal, Monday, May 24th, the Queen's birthday.

THE war series is continued in the May *Century* by a valuable illustrated posthumous article by General McClellan, "From the Peninsula to Antietam;" "McClellan at the Head of the Grand Army," by Warren Lee Goss, and "The Battle of South Mountain, or Boonsboro'," by Gen. D. H. Hill. Among other illustrated contributions to this number are the first of an architectural series by Mrs. Schuyler Van Rensselaer on "American Country Dwellings;" "The Flour-Mills of Minneapolis," by Eugene V. Smalley; "A Californian's Gift to Science: Lick Observatory," by Taliesin Evans, and "The Breeding of Fancy Pigeons," by E. S. Starr.

Outing for May appears in the fresh and breezy shape appropriate to the month. Among the illustrated articles are "Ranch Life and Game Shooting in the West," by Theo. Roosevelt, and "British Yachting," by C. J. C. McAllister, both excellent effects of pen and pencil. The bicycle is well represented by two papers, "The Stanley Show" and "Around the World on a Bicycle;" the latter being one of Mr. Thos. Stevens' entertaining papers on his novel experiences in the east. The rest of the issue is as admirable as ever in make-up and material.

CASSELL'S *Magazine of Art* for May is the usual admirable resumé of artistically illustrated good reading for which it is well-known. One of Millet's famous paintings—"The Bean Gatherer"—forms the frontispiece, and is an admirable reproduction of a prominent example of the famous Morgan collection. "Ceilings and Walls," "An English Sculptor" and "Art in Metal Work," are all excellently illustrated and written papers on their several subjects, while the balance of the issue fully sustains its general high standard.

VOL. 1, No. 17, of Cassell's *National Library* is Macaulay's "Francis Bacon," and fully sustains the standard of excellence to which these publications have attained. The judgment used in selecting subjects is worthy of al praise. while the contents, shape and appearance of the volumes, make them a valuable acquisition to the reader.

THE *Illustrated Graphic News* of Chicago for the 22d is an admirable number both in illustrations and matter. The article and cuts on the St. Louis bench-show are excellent, while the whole issue is bright and thoroughly readable.

Street-Railways.

American Street-Railway Association.

President.—Julius S. Walsh, President Citizens' Railway Company, St. Louis, Mo.

First Vice-President.—William White, President Dry Dock, East Broadway and Battery Railroad Company, New York City.

Second Vice-President.—C. B. Holmes, President Chicago City Railway Company, Chicago, Ill.

Third Vice-President.—Samuel Little, Treasurer Highland Street-Railway Company, Boston, Mass.

Secretary and Treasurer.—William J. Richardson, Secretary Atlantic Avenue Railroad Company, Brooklyn, N. Y.

Office of the Association, cor. Atlantic and Third Avenues, Brooklyn, N.Y.

The Fifth Annual Convention of the Association will meet in Cincinnati, O., on Wednesday, October 20th, 1886.

THE MIGHT OF RIGHT.

THE result of this most uncalled for among recent strikes seems to be fully in accord with the present public feeling, which of late and naturally has undergone a complete revolution. It is unnecessary to recapitulate the causes and demerits of this special instance of the workingman's apparent lack of reasoning power, since they are in all details already public property. There was absolutely no justification for the course taken, as the claims made were not in the nature of betterments in the condition of the strikers, but simply an insolently arbitrary command that certain features of the managing policy of the company, objectionable to some labor order, should be at once eliminated.

There can be no doubt that the strike resulted wholly from the pernicious effect and impression made upon the leaders by the injudicious, but evident public sympathy accorded in the preceeding strike, where at least there were reasonable and comprehensible demands made, and some grievances deserving redress.

In the former case the immense strength and vast value of having the public as an ally was plainly demonstrated. The strikers and their friends by no means kept within the bounds of law, but so strong was public sympathy, and so readily the justice of their demands admitted, that they were enabled to employ with impunity the same weapons whose use, in the present instance, brought down on them universal condemnation.

It is unfortunately true that there is much labor underpaid in this, as in other countries; just as there are many manufactured commodities which would not bring their cost price in open market, but the cause is the same in both cases. Nevertheless, it is not unnatural to feel a sympathy with human property when it fails to bring a living price, as broadly speaking, it may be claimed that every man willing to work should be able to command a decent existence in return for his labor. In consequence of this natural feeling, the public is prone in its sympathy to indulgently overlook many slight infractions of the law, as the people, feeling that the demands are reasonable, are ready to view the illegal acts with some degree of laxity.

A comparison drawn between the late general horse-car strike and the present Third avenue, is a perfect illustration of the golden truth that, to be in the right is half the battle. In the course of the former general tie up the strikers committed many and far more flagrant infractions of the laws and rights of others, but they were fighting for what was felt to be their due, and asked little more than the right to live with barely decency, and enlisting on their side the public, were therein invincible.

It is perhaps not surprising that the strikers failed to recognize the true cause of their power and success, but intoxicated with their triumph, attributed the result solely to their intrinsic strength; but the deductions drawn by them were unfortunately erroneous, as they have probably by this time reluctantly recognized. The present strike was unjustifiable, and while they have committed far fewer infractions of the law than in the former tie-up, and as a whole may be considered fairly orderly and law-abiding, they have met disastrous failure.

Corporations have few friends, as their experience with juries has painfully impressed upon them; and, therefore, to obtain the sympathy of the public requires indisputable evidence that in a controversy they are right and their opponents wrong. So it was in the present instance, or otherwise victory would again have perched upon the standard of the workers, to capital's confusion.

MR. MILLER'S "FUN."

MR. MILLER, the light-hearted gentleman, who, as a pleasant little jest, humorously placed a stone in the slot of the cable road operated by the Third Avenue line, has been by an unappreciative jury convicted of malicious mischief. This means that there is a very fair prospect of a most original joker tarrying for a space within the hospitable walls of Sing Sing.

Mr. Miller, in his own defense, distinctly stated and testified that his sole and single motive was to afford innocent amusement to the passengers of the coming car, by means of the ludicrous attitudes and positions which the smash-up would produce. To accomplish this laudable purpose he used the simplest and most efficacious means in his power: that is, wedged a stone in the track-slot—"in fun."

Unfortunately for so merry and pranksome a spirit, he had to deal with a judge and jury singularly deficient in that sense of humor on which we Americans so pride ourselves. Not only did they absolutely refuse to grasp the point of this jest, but went the outrageous length of claiming that it was no jest at all, but a highly reprehensible, and even criminal outrage; for which they held that the merry Mr. Miller must suffer incarceration in addition to nonappreciation of his joke.

Mr. Miller very properly considers that trial by jury is

a mockery on justice; but in the solitude of his State appartment he may console himself with the reflection that it was his misfortune, not his fault, to have his praiseworthy effort to afford "fun" submittted to the judgment of men so utterly deficient in a proper sense of humor.

The Arcade Railway.

THE Governor has signed the bill authorizing the much talked of underground arcade railway. If but one-half the promises made by the projectors are fulfilled, and a still smaller fraction of their agreements as to damage, etc., adhered to, the Governor will be more than justified in his action. With the apparent thoroughly responsible backing and good names identified therewith, the scheme, if eventually brought to completion, should prove the missing link between Harlem and the Battery.

FORM OF STREET-CAR BODIES.

BY W. P. EDWARDS.

[Written for the AMERICAN RAILROAD JOURNAL.]

THE remark recently made by a large holder in street-railway stock, that he saw no reason why the next lot of cars which he intended to purchase should not have the same shape as those of the new Broadway road, is very suggestive. These new cars have very straight sides, and even to an inexperienced person present a striking contrast to the more common form. The fact that so important a road has adopted such a style, has its influence in setting a fashion. This was, no doubt, the reason for the remark.

It should be generally understood that the straight body has been adopted to a certain extent under protest. Broadway is a comparatively narrow street and is crowded with business. It was therefore necessary to give the traffic as much space as possible by crowding the car-tracks. This having been done, it was found that the standard body which had for years been used on most of the roads in the city, was so wide that a man could not stand between the tracks when cars were passing. A narrower body was in consequence adopted, and the shape had to be modified accordingly. The new cars cannot be as strong nor as durable as those of the more common style, and they are certainly much less convenient and comfortable, on account of the reduced width.

The body of a horse-car is built upon principles similar to those applicable in coach-building. While both the street and steam-cars were originally modeled upon the lines of a coach-body, the steam-car, in its framing and distribution of materials, has departed radically from the original pattern. The horse-car has to resist twisting and racking strains coming from almost every direction, and is called on to carry loads greater than its own weight. The passenger-car on steam roads carries a load which is small as compared with its own weight, and has principally to resist severe endwise strains to which the street-car is never subjected. The load of an ordinary day coach on a steam road is rarely as heavy as that which may be found on almost any full-sized street-car in New York City in the "commission" hours of the evening. In one case the car is six or seven times as heavy as its load, in the other the load may be twice as heavy as the car.

To meet the conditions of street traffic, cars must be light and strong. Lightness is indispensable, because the motive-power limits the total load. After selecting our materials with a view to strength and lightness, it is found that the cylinder or globe present forms having the greatest strength in proportion to the quality of material employed. It is, therefore, best to add to material resistance of panels and posts that which may be gained by making the body convex or concave. The convex portions become so many arches to resist a change of shape. The panels are made concave or convex, as the case may be, to fit the frame. They are covered on the inside with a coarse, strong canvas or "scrims," glued fast to both panel and the posts to which the panel is attached. But this is not all. The panels are usually set in glue or lead in addition to the screws or nails by which they are held. Stays or strips of wood are glued upon them, which reinforce them and greatly increase their strength. Strong but light bracing, with rods and plates of iron and pockets for posts, hold these arches in place and make the car-body at once the strongest and lightest construction to be found in general use.

When, however, the peculiar shape of the car-body is abandoned, the advantages of the arch are lost. Straight panels have to depend upon the tenacity of the wood and canvas alone. The framing in the same way suffers a loss of stiffness. It can no longer withstand all kinds of strains without yielding. This is not a theoretical result, but one which has been taught by experience. Many years ago a road not far from New York City built its own cars, and fixed upon a form of body having almost straight panels. The bodies soon began to show signs of weakness, and, long before it was to be expected, the cars were fairly racked to pieces. As soon as the frames began to "work" or move, it was practically impossible to keep the roofs tight, and decay of the posts followed quickly. It is needless to say that the straight-sided cars were replaced by others of the ordinary form.

PROGRESS OF ELECTRICITY AS A MOTIVE-POWER.

[Report of the Special Committee read at the recent Convention of the American Street-Railway Association.]

(*Concluded.*)

IN November, 1884, important action was taken by the Manhattan Elevated Railroad, of New York, in permitting the laying of a central conductor along its Second avenue line, for the purpose of experimenting with electrical propulsion. Five electric companies, the Edison, Field, Brush, Siemens, and Daft, proposed to pool their patents, but we understand this idea was not consummated. However, experiments were begun and are still under way. The Daft system is applied to the Hampden branch of the Baltimore Union street-railway, a third rail, insulated and placed between the track-rails, is used, weighing 25 pounds per lin. yard. The Ridge Avenue Passenger Railway Company, of Philadelphia, have given permission to the American Electric Railway Company to lay a conduit and experimental line. This was the Bidwell Company,

and during the Franklin Institute Electrical Exposition, in the fall of 1884, it operated an experimental line, carrying thousands of passengers.

In 1884 it was stated that 5,872 patents in electricity had been taken out in the United States. Such is now the activity among inventors, that time will not permit a mention of many other more or less deserving motors. Your attention was called, at the last Convention, to the Bentley-Knight system at Cleveland, Ohio. It has continued in use during the past year, with most gratifying success, as we are informed. You have received copies of their pamphlet, setting forth the advantages in the use of electrical motors.

On October 20th, 1880, and February 9th, 1881, M. Camille Faure, of France patented an "accumulator"; an improvement on Plantes' secondary battery. Time will not permit an extended description. Suffice to say that an "accumulator" does not store up the electricity that is put into it; but the action of the electric currents effects certain chemical changes upon the contents of the accumulator, or does work. Like the Gramme machine, this current can be reversed and the store of work gives us currents of electricity. Once charged by electricity, the accumulator may be kept a considerable length of time without losing its power, and gives out a current steadily, similar to an ordinary voltaic cell. Patents for accumulators and storage batteries have been taken out by E. Volckmar, J. S. Sellon, C. W. Siemens, Brush, Seardel, Keith, Kabath, etc., etc. The improved Faure-Sellon-Volckmar accumulator weighs 75 pounds, and gives 1 horse-power an hour. Using steam or water-power to run a dynamo and generate electricity, with which to charge the accumulator, is much cheaper than the burning of zinc in a battery, and efforts were soon made to use these accumulators in propelling cars. The Electric Power Storage Company built a tramway car in 1883, carrying forty-six passengers. It weighed complete, without passengers, 4½ tons. The accumulators were placed under the inside seats. Fifty Faure-Sellon-Volckmar cells were used, each 11×13×7 inches, weighing 80 pounds, and capable of working the car seven hours. A Siemens dynamo under the car was connected with the accumulators by an insulated wire. A driving belt transmitted the motion from the dynamo to the axle of the car wheels. In starting the car, electricity was taken from the accumulator to the dynamo by means of a movable switch. The power required could be increased or diminished by using a larger or smaller number of cells. Reckenzaum states that from actual practice with a set of cells in propelling a forty-six passenger tram-car on experimental line, the total weight of leads and oxides of lead was 1,590 pounds, and efficiency, 71 per cent. The London *Standard* states that "Cars propelled by accumulators have been many times essayed, as in Paris and Brussels, but hitherto without approaching that practical success which is requisite for street locomotion; the excess in weight of the lead-batteries, and the comparatively small amount of power developed bringing these means to serious disadvantage. * * * Accumulators have now been produced of much less weight and far greater power, and this result has been attained without sacrifice of durability. The whole series of accumulators in the present car weighs only 1¼ tons, and the motor, gearing, and accessories, ½ ton to 1¾ tons: car, 2½ tons. Total with forty-six passengers, 5½ tons. For the electric tramway the cost of six cars, including the charging station, would give an average of £700 ($3,500)."

The electric railway at the linen bleaching works of Paul Duchesnne Fournet, at Le Breuil-en-Auge, opened in 1882, and constructed by Clovis Dupuy, is operated by Reynier-Faure accumulators. The motor consists of a reversible Siemens machine mounted on a car, with necessary mechanism, to which a tender is attached containing the accumulators. The road is 6,691 feet long; gauge, 31½ inches; weight of locomotive, 2,057 pounds; tender, 1,540; each loaded car, 1,760. Total weight of train, 14,080 pounds. Speed, 7½ miles per hour.

The electric tram-car of the French Electric Storage Company was first run in 1881. On June 24th, 1883, it made an experimental trip with thirty passengers, a distance of about 20 miles. Speed, 7½ miles per hour. Total weight of tram-car, about 9 tons, including 80 accumulators, of 66 pounds each. Electric power furnished equalled 7½ horse power during 2½ hours.

In conclusion, your committee consider the application of electricity to the propulsion of street-cars as entirely feasible. The seven electric railways in Europe, besides the tests in this country, prove this to be true. It is now narrowed down simply to a question of dollars and cents, or comparative economy with horses, cable power, etc. In the crowded streets of the American cities, no system of overhead wires would be permitted by the municipal authorities. The rails could not be used to carry the currents, for obvious reasons, therefore a conduit system offers the only practical solution. The system of running cars by accumulators can be applied with least trouble and less first cost, but at a great sacrifice of electricity. The result of two years' working of the electric railway at Zankerode, Prussia, showed that only 30 per cent. of the power of the steam-engine was applicable to the propulsion of cars, but even this compares favorably with the cable system. Our worthy fellow-member, Mr. C. B. Holmes, president of the Chicago City Railway, stated at our last convention (see page 150 of proceedings), "The total amount of power required for ordinary operation is 477 horse-power. Of that it takes 389 to run the machine and the cable. This equals 81½ per cent., or 18½ per cent. of useful power. An efficiency of 50 per cent. and over, is claimed for recent improvements in electrical transmission. If this is realized, the efficiency of the electric railway will be nearly 300 per cent. greater than the above cable railway.

If electricity be used to charge accumulators, there is said to be a further loss of 30 per cent., therefore your committee do not favor the use of accumulators.

The following letter from the Bentley-Knight Electric Railway Company, proves that capital in their hands considers the problem solved.

ROWLAND R. HAZARD, President.
ROBERT W. BLACKWELL, Secretary.
WALTER H. KNIGHT, Chief Engineer.
EDWARD M. BENTLEY, Consulting Engineer.

THE BENTLEY-KNIGHT ELECTRIC RAILWAY COMPANY.

No. 115 Broadway, NEW YORK, June 22d, 1885.

AUGUSTINE W. WRIGHT, ESQ.,

Supt. Track and Construction, North Chicago City Railway.

MY DEAR SIR: I desire to call the attention of your committee of the Street-Railway Association on "Electricity as a Motive Power," to the system of the Bently-Knight Electric Railway Co., of this city.

This corporation is now ready, after long and exhaustive experimentation and trial, to take contracts for the construction, equipment, and operation of electric tramways, and to furnish estimates of cost of construction and running expenses upon demand. It is able and willing to equip any line fully, and to operate the same for any given time before asking compensation, and is willing to stipulate that, should its plant not give full satisfaction to the parties contracting, it will remove the same at its own cost.

For our system we claim every advantage, and none of the disadvantages of horseflesh, steam, or cable. We can guarantee economy, cleanliness, speed, perfect stop and start, and equal ease in running either forward or backward. If you are willing to look into the matter we shall be more than happy to discuss the question with you, either personally or by mail, to answer any questions you may make, and to furnish estimates upon any section of road, the particulars of which you will furnish us.

Very respectfully,

ROBERT W. BLACKWELL, Secretary.

The chairman of this committee asked at the last convention whether this was the same Mr. Bentley who reported "On a large scale electricity as a motor is only useful in transferring power to convenient localities, as when a machine which generates a current, is driven by a distant waterfall, but the transmission of power into electricity and then its re-translation from electricity into power entail serious losses. That the electric motor must remain subordinate to steam, water, or original force until a new and cheaper source is discovered." It *is* the same Mr. Bentley, but he was instructed to continue his experiments, and the result has been the successful solution of the problem, to the entire satisfaction of the capital interested in the Bentley-Knight system. "Money talks!" and any member of this convention running a sufficient number of cars, can thoroughly test "Electricity as a Motive Power," without money and without price, until convinced of its entire practicability and economy.

AUGUSTINE W. WRIGHT.
J. A. CHASE.

Medical Attendance on the New York Elevated Railways.

IN an interview with a New York *Herald* reporter one of the medical staff of the Manhattan Elevated Railway recently made the following statement:

"All accidents, whether serious or not, are reported to us by telegraph, whether of passengers or our own employés. Our operators at the Bleecker street station communicate at once with police headquarters from the west side, and so do the Houston street men on the east side in case of serious accident. Further than this, as we have about 4,000 men in our employ, policemen are provided with cards which they can give to any one requiring our assistance, and thus prevent imposition. This card authorizes a policeman to use our telegraph system for the purpose of either obtaining an ambulance or for notifying us for immediate attendance. Small injuries are, however, the most numerous. We pay for our men if taken to a hospital; or if taken home we go and visit them and keep a general supervision over them, so that they are well cared for. Slighter injuries are attended to right here, of which we have about thirty cases a week. The closets of the room are filled with all sorts of medicaments, salves, lint, bandages, etc. A large portable medical satchel, filled with the necessary instruments and bandages, stands ready for a case of emergency, and is carried by the surgeons on duty.

"Out of the 4,000 employés there were at least 500 repair men always on duty. It is these men who get constantly injured, principally in the eyes; so do also the couplers of cars. Trackmen, who must listen with their ears close to the rails whether they hear any noise—the flag division especially—in foggy weather are apt to slip; and these accidents from slipping are more numerous, especially in winter time, than all other mishaps. But the most fruitful source of accidents is the thoughtlessness and ire of passengers attacking our trainmen—'guards' they are called. The gates must be shut when ordered. Now, only a day or two ago we had one of our guards here who may probably lose his eye. His condition was very serious. An irate passenger, because the gate was shut, struck him across the eye with a heavy cane, and the poor fellow may lose his sight forever. Of course, neither he nor do we know who the assailant is, as the train was just moving off when the guard was struck. But these assaults occur almost daily, and they are quite numerous on the midnight-trains. It is but right, therefore, that the company should provide for the medical care of its employés, and we are here to attend to this business.

"Among other functions discharged by these surgeons is the examination of all employés for color blindness, sight and hearing. Those no longer considered in sound condition are given other and less important positions where these physical qualities are of no such great consequence. No expense whatever is attached to the medical treatment of employés of the elevated road."

Street-Car Propulsion in Great Britain.

IN Great Britain the expense of horse feed is much higher than it is in America, so that the expense of operating street-railways with horses reaches very high. Efforts have constantly been made for years to introduce a cheaper motive-power, but this far without success. Steam motors have had a limited application, but the municipal boards object to having them in the public streets, so their use is obstructed by annoying ordinances. When the Portrush Electric Tramway was opened in Ireland two years ago, it was expected that the experience gained in the actual operation of that road would lead the way to operating ordinary street-railways by electricity, but nothing has come of it. The application of electricity to car propulsion, says the *National Car-Builder*, is recognized as being still in the experimental stage and capitalists will not put money into experimental schemes that promise so little financial return. In Manchester, there has lately been considerable agitation in favor of introducing the cable system of street-car propulsion. The practical success of this system in San Francisco and Chicago is cited as good reason why it should be introduced in Manchester.

The Manchester engineering world has been familiar with cable traction almost since this century began, and it is surprising that it has not been tried more for street-car traction. If we remember rightly, the Blackwell Railway in London was first opened as a cable road some fifty years ago or more. That was a failure, principally through defects in the mechanical details, and the loss incurred by the promoters of the enterprise may have deterred others from entering into similar schemes.

An Electric Cable Railroad in Denver.

THE first successful attempt at trial trips of the new cable-car has been made in Denver, says the *News* of that city, over a portion of the track of the Denver Electric and Cable Railroad Company, on Fifteenth street. The car ran a considerable distance, and at the satisfactory rate of eight miles per hour. A dynamo 20 horse-power furnishes the motive-power for the car. Quite a large number of prominent citizens took rides on the car. Prof. S. H. Short, of the Denver University, has worked very hard to make his invention a success, and his efforts seem to be already reaping their reward. The company have hoped to get their cars running in six weeks or a month. The car which is now being used in making trial trips is shaped and fitted up very much like an ordinary street-car, and is fully as handsome in its style and appointments as any street-car in Denver. It was made by Woeber Brothers, of Denver. The dynamo and other machinery, which is located in a building near the corner Fifteenth and Tremont streets, and which is used to propel the car, was made by F. M. Davis, of Denver, and all the plant and material used by the company will be of Denver manufacture. Ex-Governor John Evans, W. N. Byers, Rodney Curtis and other well-known Denver gentlemen are among the officials and directors of the new company. Some further trips will be made by the car, and large numbers of people will undoubtedly visit Fifteenth street, just below the court-house and between Tremont and Glenarm streets, and inspect the invention and its workings.

A Novel Rubber Spring.

AT a late meeting of the Engineers' Club, of Philadelphia, Mr. Howard Constable described a novel rubber spring for tram-cars, railway draw-bars, buffers, and the like. It consists of a cylindrical piece of rubber with a hole through the axis, and capped at both ends with bearing-plates; the draw-bar or location bolt, of course, passes through the bearing-plates and rubber spring. The peculiar feature is that a steel spring encircles the rubber, so that as the rubber is compressed it is reinforced by an increasing resistance on the part of the steel spring, which tends to hug it back to its original form. It presents some excellent features for long range, endurance, uniformity or gradation of resistance, and freedom from danger in collapse, as well as economy. It is being extensively used in England, and one that has been under test by the chief engineer of the North Eastern Railway, has withstood, up to the present time, over 1,000,000 depressions of five tons. A model was shown, and it should be noted that the steel ring is not solid, but laps over itself, so that the ends slide over each other as the rubber presses the spring outward; also that the section of the spring can be U, W, or other shape.

"L" Roads in Disfavor in St. Louis.

AN elevated electric railway bill, passed by the city councils of St. Louis, has been vetoed by Mayor Francis, who says in his message: "An elevated railway, with electricity as the exclusive motor power, to be restricted to the carrying of passengers, would be a credit to the city and undoubtedly a benefit to the people at large; but the rights of property damaged by its construction should be securely protected, and the bill should be so framed as to leave no question as to the exclusion of steam as a motor, or as to the possibility of its being converted into a freight road while in the hands of its projectors or their successors."

A New Electric Engine for Street-Cars.

A NEW electric tram-engine was shown recently at the station of the North Metropolitan Tramway Company, Stratford, England. This is a center at which fair trials have always been accorded to any new motor, and it is understood that in the event of the new inventors and the tramway company agreeing upon terms, a practical experiment of no small importance will be made in electric tramway up on the new line to Ilford. The electrical engineers in this case are the Electric Locomotive and Power Company (Limited), who claim to have solved the problem of economical working by combining the electrical power with the mechanical aid of the lever principle. The electro-motor is connected by pinions horizontally with a large stationary rack and vertically with the wheels. When the electrical engine is started the pinion of the horizontal armature geers into the stationary rack, and so causes the motor itself to revolve. The motor then becomes, by the action of its fixed vertical shaft, the driving-axle and communicates its motion to the wheels of the car. By means of clutches a backward or forward motion can be secured without reversing the direction in which the electro-motor is revolving. The electricity is supplied from fifty cells of, say, a total of 280 amperes. It is claimed that the average discharge is from forty to forty-five amperes per hour, and that an engine consuming only two tons of coal per week will charge batteries sufficient to do the work of four cars requiring at present forty-four horses per week. The engine appears to be controlled with perfect ease, and though at present it is fitted up separately from the car itself so as to take the place of horses and utilize existing cars, the company claims that it can in future easily be constructed as a part of the passenger-car.

New Compressed-Air Motor.

A PITTSBURGH mechanic claims to have invented a compressed-air motor for street-car travel, on an entirely new and economical principle. The front wheels are unusually large, and there are small air-pumps, three inches stroke by three diameter, set in the periphery of the wheels. The force of the air-pump is exerted by the weight of the car over the wheel, calculated at 1,000 pounds to each wheel. The air thus compressed passes into the hollow hub of the wheel, whence it carries its force into the receiver.

Experiments in Germany.

PROTRACTED and carefully conducted tests have late been made in Germany to ascertain the relative expense of operating street-railways with horses, electricity and caloric motors. The caloric motor was the Honigmann caustic-soda locomotive, described in the April number

of the AMERICAN RAILROAD JOURNAL. The trials were carried out by the Great Berlin Street-Car Company, and the results have just been made public. Both the electric and caloric motors worked satisfactorily, causing no delays or irregularity of travel, but in both cases their operation was much more expensive than the cost of working the cars with horses. The company found no reason why horses should be displaced by the motors at greater expense.

Increase of Rolling-Stock on the Elevated Roads.

THE rolling-stock of the elevated railroads of New York will shortly be increased considerably. The roads are operated with a very small margin of cars and locomotives, and the recent increase of traffic has reduced the spare stock so much that inconvenience has been experienced in making repairs. New cars and locomotives of the standard pattern have been ordered.

STREET-RAILWAY NOTES.

ALABAMA.

THE Capitol City Street-Railway Company, of Montgomery, is operating its line with the Van De Poele electric system with success. The line is about six miles in length.

The Birmingham Street-Railway Company has increased its capital to $60,000. The line is being extended and a new stable built.

At Tuscaloosa a street-railway company is being organized.

CALIFORNIA.

At Los Angeles a franchise for an electric street-railway has been granted to C. H. Howland.

DISTRICT OF COLUMBIA.

A cable company, in which the Philadelphia Traction Company is interested, is seeking power to build a line in Washington.

FLORIDA.

The Orlando Street-Railway Company has been incorporated by W. S. Copeland, N. Poyntz and others. The line will be about ten miles long. Capital stock, $50,000.

The Jacksonville Belt Railroad Company has been organized to build a street-railway three miles in length.

GEORGIA.

The Metropolitan Street-Railroad Company, of Atlanta, will extend its line to Grant's Park. New cars have been received.

At Macon a street-railway has been opened to East Macon; it is proposed to extend the line to Gilesville, making a four-mile run.

ILLINOIS.

The Arcade Rapid Transit Company, of Chicago, proposes to build an underground railway. Among the promoters are S. T. Whipple, C. H. Crawford and L. Clark.

The South Side Street-Railway Company, of Chicago, will extend its line to Sixty-ninth street and Washington Park.

The Commercial Avenue Street-Railway Company, of Cairo, has been incorporated by Dennis J. Foley, John Hogan, John M. Lansden and Angus Lek. Capital stock, $10,000.

KENTUCKY.

The Anderson Hill Inclined Railroad Company has been incorporated.

The Enterprise Street-Railway Company, of Louisville, has been incorporated. Capital, $100,000.

The Falls City Street-Railway Company has been organized by A. Strauss and others.

MASSACHUSETTS.

The Fitchburg Street-Railway Company has been incorporated by Eliah Parker and others, with a capital of $60,000.

The Globe Street-Railway Company, of Fall River, has had a survey made for an extension of its line on South Main street.

The Hoosac Valley Street-Railway Company, of Adams, has been incorporated by T. P. Thayer and others. Capital, $50,000.

The Middlesex Horse Railroad Company, of Malden, will lay a double-track between Malden and Charlestown.

The Pittsfield Street-Railway Company has been incorporated by T. Clapp, T. L. Allen and others. Capital stock, $50,000. The survey has been made, and Mr. Guilds, one of the Boston directors, will reside in Pittsfield to superintend the construction.

At Worcester the contract for the street-railway has been let to F. S. Stevens, of Cambridge. The West Side and Quinsigamond lines are to be completed by July 15.

MICHIGAN.

The Grand River Avenue Street-Railroad Company is extending its line on Myrtle street. New buildings are being erected.

The cable railway project for Grand Rapids has been abandoned for want of support.

At Kalamazoo $2,000 bonus has been subscribed for the construction of a new street-railway.

At Lake Linden $10,000 have been raised towards a new street-railway.

MINNESOTA.

The Mankato Street-Railway Company has ordered its new cars to be delivered June 1.

MISSOURI.

The Grand Avenue Railway Company, of Kansas City, will build several lines of cable track. President, W. J. Smith; engineers, Knight and Bontecou.

The Kansas City and Rosedale Street-Railroad is to be put into the hands of a receiver until the difficulties with the directors are adjusted.

NEW HAMPSHIRE.

At Nashua work has been commenced on the street-railway.

NEW JERSEY.

At Bridgeton a new street-railway is contemplated. Oberlin Smith, of that place, is among those interested.

The Elizabeth and Newark Horse Railroad Company will build a line from the Lyons Farm branch to Mount Olivet Cemetery.

New Inventions.

La Dow's Harness.

CHARLES LA DOW, of Albany, N. Y., is the inventor of a new and improved form of harness for horses, which is herewith illustrated and described. This invention relates to that class of harness draft devices employing a yoke suspended, preferably, beneath the team, dispensing with traces connected with a double-tree at the rear of the team, and principally consists in suspending beneath each horse a curved yoke connected by short traces to the collar, and adjustably connecting each yoke to the horizontal evener-bar beneath the horses.

In the accompanying cuts, Fig. 1 is a perspective view of the appliance attached to a team and pole, and Fig. 2 a top view of the yokes linked to the evener-bar and draft-link a^2.

A band of tempered steel or other suitable material C, arched downwardly, is employed to pass from side to side beneath each horse, and each end of said band is bent out-

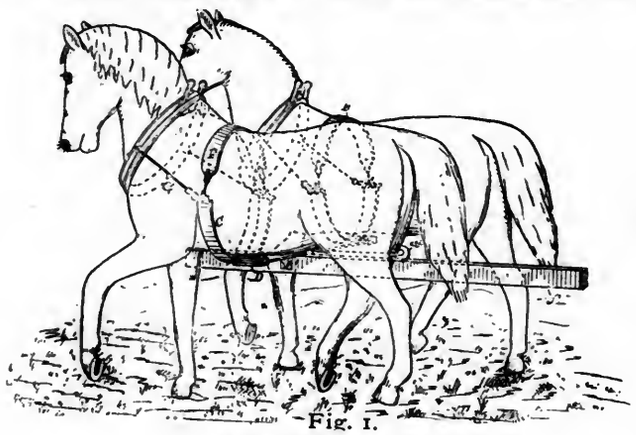


Fig. 1.

LA DOW'S HARNESS.

wardly into a lip and perforation *c*, so that the tug and back-band couplings shall not rub against the horse. For each yoke a back-band F, is provided, each end of which is hooked into its respective eye *c*. Short tugs G, pass from the collar to each end of the yoke and hook in the eye *c*. The back-band and arched yoke thus encircle the horse, and are readily detached from each other or from the tugs. Each yoke is at its lower part mounted on an evener-bar B, preferably by means of a double-pivoted lateral moving link. These links are preferably constructed of two plates, each provided with a lip E, having an annular groove for the reception of anti-friction balls. Between the lips of these two plates is pivoted a yoke so that it can rotate freely upon its pivot *c'*, and between the circles of balls, in concert with the alternate motions of the horse's shoulders. These links are pivoted to the ends of the evener-bar B, which is provided with holes *d*, for the reception of the pivot, so that the yokes may be adjustably attached thereto, whereby the team can be harnessed near together or far apart. These links are also preferably adjustable in length. By this method of attachment each yoke has a lateral motion relatively to the evener-bar, to allow ample latitude for the swaying of the horses in the harness or the lateral swaying of the evener-bar. The object to be hauled by the team is attached to the evener-bar by means of a pole or chain or suitable draft-link,

It is obvious that, as the power of the team is applied through the upper lips or ends of the yokes, the yokes are subjected to torsional strain, which reacts directly through the yoke-links D, and tends to elevate their rear ends and the evener-bar pivoted thereto. The yoke-links are therefore constructed rigid in cross-section, and preferably adjustable in length, so that the draft of the load to be moved by the team, acting through the links, shall counterbalance the torsion-strain of the yokes and maintain the yokes in a vertical position beneath the team.

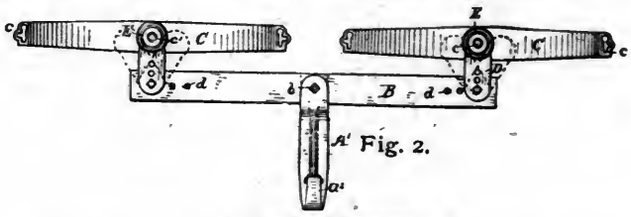


Fig. 2.

LA DOW'S HARNESS.

The weight of this harness is not carried by the team, except when they are not drawing a load, for the draft tends to lift the harness free from the horses backs, rendering it cool and easy to work in. It can be put on and taken off more readily and in less time than other harness, and there are no long traces for the horses legs to become entangled with when turning corners.

It is claimed for this device that it is simple yet effective, while strong and durable, and attains an even division of the pulling-power, reducing the wear and strain to a minimum.

Gibson's Street-Scraper and Snow-Plow.

GEORGE G. GIBSON, of St. Louis, Mo., is the inventor of a new and improved form of street-scraper and snow-plow, which is herewith illustrated and described. The invention relates to the construction of street-scrapers and snow-plows for cleaning streets and roads, and though of general utility, wherever such apparatus is required, it is specially so where the streets are paved, where car-tracks, uneven surfaces, gutters, or raised crossings exist.

In the accompanying cuts, Fig. 1 is a plan view; Fig. 2 is a side elevation, and Fig. 3 an enlarged detail view, of a scraper or snow-plow embodying the invention.

A indicates the bed of the car or carriage from which the scraper is suspended by chains, ropes, or in any approved or suitable manner, and B the scraper, which is made up of a series of plates *b*, pivoted on each other, as at *v*, so as to insure flexibility of the blade as a whole and enable each section to adapt itself to the surface over which it is passing without disturbing or displacing the other plates of the series. This scraper-blade composed of the pivoted plates *b*, is connected at each end by a pivotal bolt *c* and *c'*, to a stretcher-bar C, which occupies the position of the usual plank straight-edged scraper in common use, and the stretcher C, whose only function is to sustain the flexible blade and maintain the vertical position of the plates, may be of plank or any suitable material.

In order to permit the movement of the plates or scraper longitudinally sufficient to render them capable of accom-

modating themselves to inequalities, or to concave or convex surfaces, both of which are found on car-tracks and most roads, one of the bolts c', moves in a slot which may be made either in the plate or in the stretcher C, The several plates are each connected with a suspension-bar D, by a chain or other flexible connection d, and, if desired, the plates may have shanks or arms d', for attaching the chain, though this latter feature is not essential. The suspension-bar D, is in turn connected by a chain or other flexible connection d^2, with a lever E, pivoted on the car or carriage bed A, which lever serves to raise or lower the scraper.

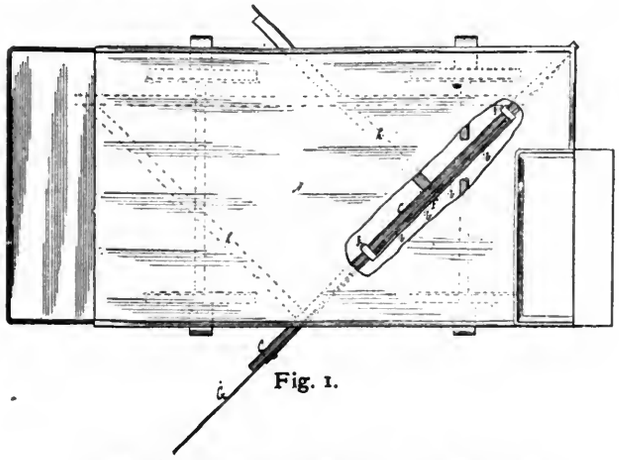


Fig. 1.

GIBSON'S STREET-SCRAPER AND SNOW-PLOW.

F indicates a saddle or brace-bar, which is supported or rides on the stretcher C, and, if desired, may be secured thereto by clamp-bolts or screws f. This brace-bar F, aids in preventing the tilting of the sections or plates b, when the scraper is in use. It is valuable, but not essential, as the apparatus works well without it. G indicates the wings of the scraper or that portion which extends beyond the pivot-bolt C, and is composed of two or more plates, the outer one, or both, of which is controlled by a rope or chain g, passing over a pulley g'', to the lever E, or other fastening within reach of the driver. In case of single-plate wings, only level or evenly-inclined surfaces can be scraped, whereas by sectioning this wing-piece irregular surfaces may be cleaned. The scraper, as usual, is set angling or obliquely to the line of travel, and is

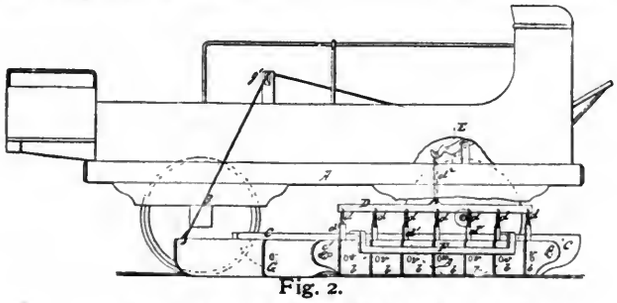


Fig. 2.

GIBSON'S STREET-SCRAPER AND SNOW-PLOW.

properly supported by diagonal braces h, of wood, iron, or any suitable material, which extend from the stretcher C, to the frame-work thereof, as shown in Fig. 1.

It will be noted on reference to Fig. 3 that the devices are shown as in use for scraping a car-track, as they are especially adapted for removing, snow, etc., therefrom. For such purposes the outer plates or sections, which are pivoted on the stretcher, should be curved in on the edge, as at m, so as to come within the rail, and this will be of special importance where the track may be either convex or guttered, as shown in dotted line in Fig. 3, or worn irregular by the travel.

The device being substantially as hereinbefore described, the scraper will be lowered into operation in the usual manner by means of the lever E, and rope g, the stretcher bar or plank riding the rail, (if for clearing tracks), and the flexible or floatiug blade B, will, by the independent movement of its plates b, accommodate itself to the character of the surface over which any part of the blade is

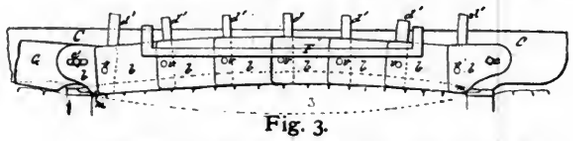


Fig. 3.

GIBSON'S STREET-SCRAPER AND SNOW-PLOW.

passing. If a crossing or gutter is encountered, each plate will in its turn sag or enter, and pass from the gutter or rise and ride over the crossing without straining or disturbing the remaining sections, and the play of the section on bolt c', will allow the blade to expand or contract to pass the horizontal line in dropping from a convex into a concave track.

It is claimed by the inventor that objections and difficulties attending the ordinary rigid single-blade machines, or those constructed with the blades made up of short independent spring or gravity sections, are wholly overcome by this device, which provides a sectional practically continuous or flexible scraper-blade, which will accommodate itself to an uneven surface without requiring either to be lifted, or suffer injury in going over the obstructions constantly met with in use.

Tucker's Nut-Lock.

MORRIS W. TUCKER, of Sumner, Mich., is the inventor of an improved and new form of nut-lock, which is herewith illustrated and described. The invention relates to that form of nut-lock adapted for use on railway fish-plates and pertains to the construction of the fish-plates themselves, the same being adapted to receive an ordinary bolt and nut, the bolt being locked by the position it occupies relative to said plates when the operation of applying the same has been completed.

In the accompanying cuts, Fig. 1 is a vertical cross-section of a device embodying the invention, and Fig. 2 a separate view of one of the plates, showing the position of the bolts in dotted lines when the device has been applied.

A represents a rail, perforated, as shown at a, to receive the bolts by which the plates are engaged therewith. B represents an ordinary bolt, squared adjacent to the head, as shown at b'. B' is a nut, and C represents a fish-plate, countersunk, as shown at c, to correspond with the shape of the nuts, and in which they are held from turning.

C' represents the corresponding plate, provided with elongated slots, as shown at c'. These slots are constructed, preferably, as shown in Fig. 2, one extremity being rounded, so that the squared end of the bolt may rotate therein as the bolt is being tightened in place.

Toward the opposite end of the slot the plate is cut away slightly above and below, as shown at c^2 and c^3, leaving a shoulder at c^4.

The plates are secured in place and the bolt locked in connection therewith in the following manner: It is obvious that the plate C, being countersunk to correspond to the shape of the nut, there can be no turning of the nut itself.

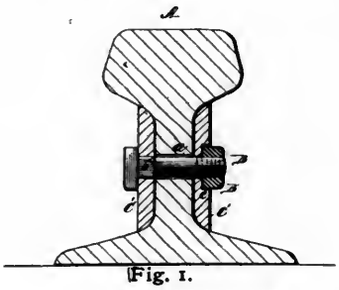


Fig. 1.

TUCKER'S NUT-LOCK.

In the application of the plates the bolt is inserted in the rounded end of the slot c', in the plate C'. The bolt is then rotated, and thereby the plates are tightened upon the rail. When this has been accomplished, the plate C', is driven, so as to bring the bolt toward the opposite end of the slot c', adjacent to the cut-away parts of the slot and beyond the shoulder c^4. Then, by a slight turning of the bolt in the proper direction, one of the corners of the squared end will engage behind the shoulder, to effectually prevent the plate from working, forming an effectual lock, as it is evident that the bolt can only be turned when brought into the rounded end of the slot in the fish-plate C'. This cannot be done in any accidental manner, it being prevented by driving the plate, as described, in the proper direction and turning the bolt so that one of its corners falls behind the shoulder c^4, thus constituting a very simple device, easily applied.

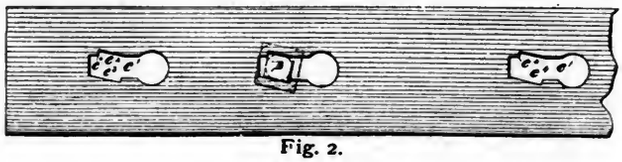


Fig. 2.

TUCKER'S NUT-LOCK.

Should there be any occasion for the removal of the fish-plates, the bolt can be turned back so that the plate C', may be forced back on the bolt, so that the bolt shall occupy the rounded end of the slot, when it may be unloosed.

It is claimed by the inventor that this form of nut-lock is simple and durable, and while involving no extra parts it may be most economically constructed; it is thoroughly effective and reliable.

Fuller's Station-Indicator.

WATSON S. FULLER, of Atlanta, Ga., is the inventor of a new and improved form of station-indicator, the construction and operation of which is herewith illustrated and described.

The invention relates to that form of station-indicator so constructed as to show and indicate the successive station names in proper order in several parts of the car at the same time, so that all the occupants of the car can easily see the several names, and consists in the combination, with a shaft, of a series of rollers or drums on the same, boxes surrounding the drums, and rollers or drums journaled in the boxes below the drums on the shaft; and to each pair of drums or rollers in each box a band is secured, on which the names of the stations are produced. On one end of the shaft a cog-wheel is secured, which engages with a pinion provided with a handle having a pin, which can be passed into apertures in the side of a box surrounding the cog-wheels, for the purpose of holding the shaft in place.

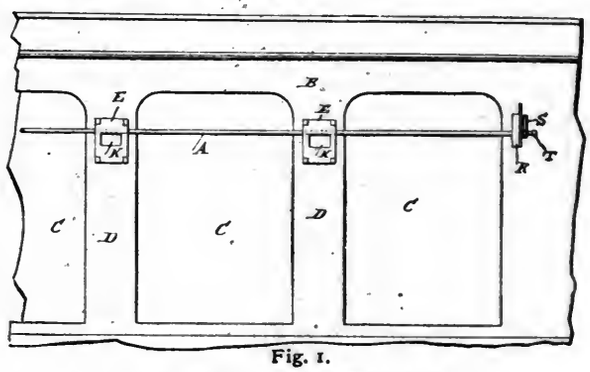


Fig. 1.

FULLER'S STATION-INDICATOR.

In the accompanying cuts, Fig. 1 is a longitudinal elevation of part of the inside of a car provided with the improved station-indicator; Fig. 2 a front view of one indicator-box, parts being broken out; Fig. 3 a cross-sectional elevation of the same on the line $x\ x$ in Fig 2; Fig. 4 a side view of the same; Fig. 5 a side view of the box containing the mechanism for operating the indicator; Fig. 6 a cross-sectional view of the same on the line $y\ y$ in Fig. 5.

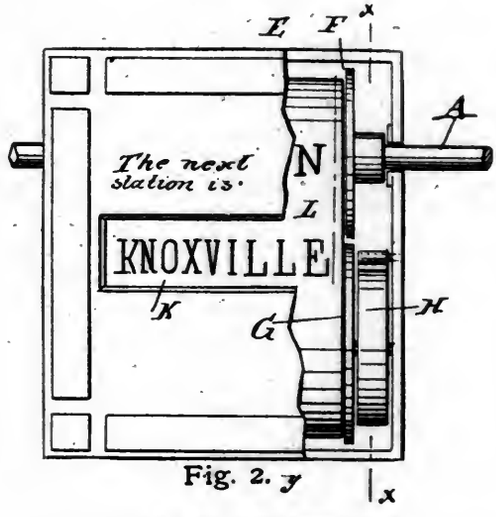


Fig. 2.

FULLER'S STATION-INDICATOR.

A horizontal rod or shaft A, is journaled on the inner side of the car B, at the top of or above the windows C, and at each pier D, or at each alternate pier, it passes through a box E. In each box E, a pulley or drum F, is mounted on the rod or shaft A, and below the drum F, a pulley or drum G, is journaled in the box, one end of a spiral spring H, being secured on one pivot of the drum G, and the other end being secured to the box.

Between the drums or rollers F G, a strip J, is arranged

parallel with the rollers, a short distance behind the front of the box E, which strip has its top and bottom edges beveled. A horizontal slot K, is produced in the front of the box E, directly in front of the strip J, and above the slot the words "The next station is," or any equivalent phrase, is produced on the front of the box E. A band or belt L, on which the names of the stations are produced transversely in their proper order, or other information, is secured to the drums or pulleys F and G, and is passed over the strip J, in the manner shown in Fig. 3.

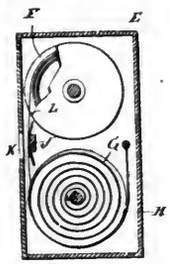


Fig. 3.

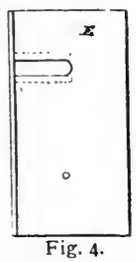


Fig. 4.

FULLER'S STATION-INDICATOR.

On the end of the shaft A, a cog-wheel M, is mounted, which engages with a pinion N, on the outer end of the pivot of which a crank-handle O, is mounted, which has a spring S, provided on its free end with a pin P, adapted to be passed into apertures Q, arranged in a circle in the sides of a box R, containing the wheels M N. The handle O, is also provided with a knob T, secured to the spring.

The operation is as follows: The bands L, in the several boxes B, are wound on the drums or rollers F, by turning the shaft A, by means of the handle O. All the springs H, are thus brought in tension. After the first station has been passed, the brakeman or conductor pulls the handle-pin P, out of its aperture Q, and moves it to the aperture Q, into which it is permitted to snap. By the above-described movement of the handle the shaft A, and the several rollers F, are turned so as to unwind as much of each band L, as is required for one station-name, and so on for each station, the several names appearing successively behind or in the slots K. The springs H,

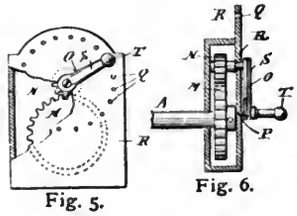


Fig. 5. Fig. 6.

FULLER'S STATION-INDICATOR.

wind the bands on the rollers G, as rapidly as they are unwound from the rollers F. When the train runs in the inverse direction, the shaft S, is turned in the inverse direction and the several bands L, are gradually wound upon the drums or pulleys F, and the springs H, are brought in tension. The indication boxes are 2¾ inches by 4 inches in size, smaller and more compact than shown in Fig. 2, which is made to show its construction distinctly.

The bands carrying the names of the stations can be removed and changed when the ouside cases are taken off without disturbing the other parts; so that a car can be easily and quickly prepared in case it is changed to another line, As the indicator consists of the combination of a number of parts all identically alike, it can be manufactured by machinery to advantage in respect to cost and workmanship.

In addition to the name of the station, there is space provided in the indicator-box to add such other information as may be useful; such as the distance to terminal stations, and names of connecting railroads at junctions; and it is claimed for the invention that it is simple and durable in construction, easy of applying, and fully answers the purpose for which it is intended.

Hale's Pendant-Car Elevated-Railway System.

PERLEY HALE, of Burlington, Ia., is the inventor of a new and improved form of pendant-car-elevated-railway system, the construction and operation of which is herewith illustrated and described.

The invention relates to that form of elevated railways having a single line of posts for supporting the track, and provided with pendant cars operated by cable or other suitable power, and the objects of the invention are: 1, to sustain the supporting-posts against side strains from wind or other causes; 2, to construct the trusses for the track in such a manner that the supporting-posts may be

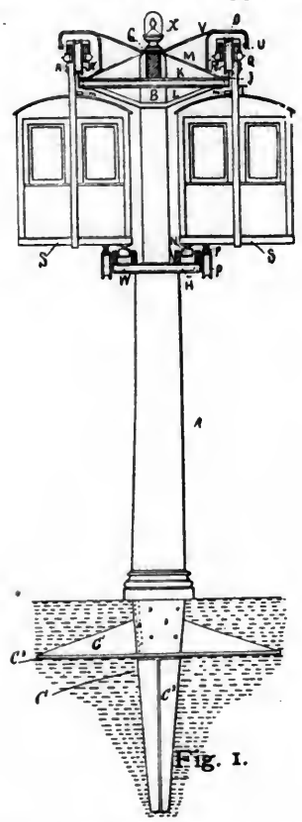


Fig. 1.

HALE'S PENDANT-CAR ELEVATED-RAILWAY SYSTEM.

set at long distances from each other, and a light structure adopted for supporting the tracks; 3, to use a vertical single truss to sustain the tracks and moving load, and to prevent the vertical single truss from "buckling," or bending either in vertical or horizontal planes; 4, to use a single rail for each line of cars with a single vertical truss and single line of supporting-posts; 5, to provide for running two or more lines of cars on single rails in opposite directions, and having the same supported by single vertical trusses

and a single line of posts; 6, to guard against accident from breakage of the wheels by suspending the cars from trucks or running-gear provided with a safety riding and stop-bar, and traveling on a rail above the car; 7, to prevent the trucks from leaving the track sidewise, and injuriously jumping on the track; 8, to guide and limit the side motion, or swinging of cars suspended or pendant from a single-track by means of the side tie-bars of the lower truss; 9, to propel two lines of cars running in opposite directions by a direct and return and traction-cable, the cables being above ground and on opposite sides of the track-support; 10, to provide for the carrying of either two or four lines of laterally-suspended, guided, and guarded cars on a single vertical truss, having a single line of post-supports; 11, to provide means for transferring pendant-cars from one side of the truss to the other, and from one track to another, by turn-tables or switches,

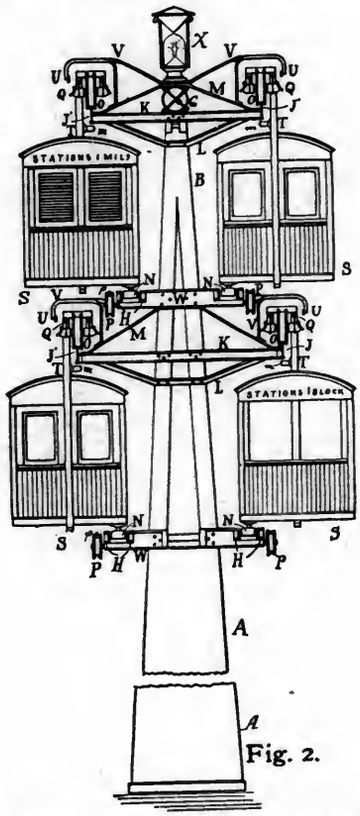


Fig. 2.

HALE'S PENDANT-CAR ELEVATED-RAILWAY SYSTEM.

or both; 12, to provide a safe means for transferring pendant cars across waterways, and thereby avoiding detention of the cars from ships or boats in such waterways; and, finally, to provide for lighting the elevated railway at night by electric or other lamps, applied upon upwardly-extended central posts of the track-support.

In the accompanying cuts, Fig. 1 is a cross-section showing the lateral overhanging top-guards and pendant cars in place; Fig. 2 a cross-view showing a four-line road constructed in accordance with the invention, and Fig. 3 a side view of the parts shown in Fig 3.

The respective posts of the elevated railway are designated by the letters A B C, the portions A B, being above ground, while the part C, having a horizontal plate C^2, with wings C', and secured to the post, is embedded so as to be beyond the influence of frost—say three to four feet below the grade—in concrete or masonry, The horizontal plate, with its wings, is applied to the post below grade in order to overcome side strains upon the elevated road, thus making the roadway more secure. Below the horizontal plate C^2, the part C^3, is made in horizontal section in form of a cross, and this form aids the plate C^2, and its cross-shaped portion C^3, in keeping the posts and superstructure firm, as shown in Fig. 1.

On each side of the posts and the connecting vertical truss will be one or more lines of cars, or as many lines of cars as there are lines of rail, those on one side to be going, while those on the other side will be returning.

In Figs. 2 and 3 is shown a structure for four lines of cars sustained by a single vertical truss. The cars (represented by S in the cuts) are pendant or suspended by central hangers T, from a truck Q, having grooved wheels O, running on the rails J J, above the car S, and provided with a safety riding and stop-bar R R'. The bar R R', is about midway between the respective pairs of wheels, being fastened to the under side of the truck and to the hanger T, and serves, when a wheel breaks, to prevent the truck running sidewise off the track, by descending upon the rail and riding upon the same with its stop R', far enough below the rail to hold the truck from passing laterally from the rail.

In Figs. 2 and 3 are also shown guards U, secured to

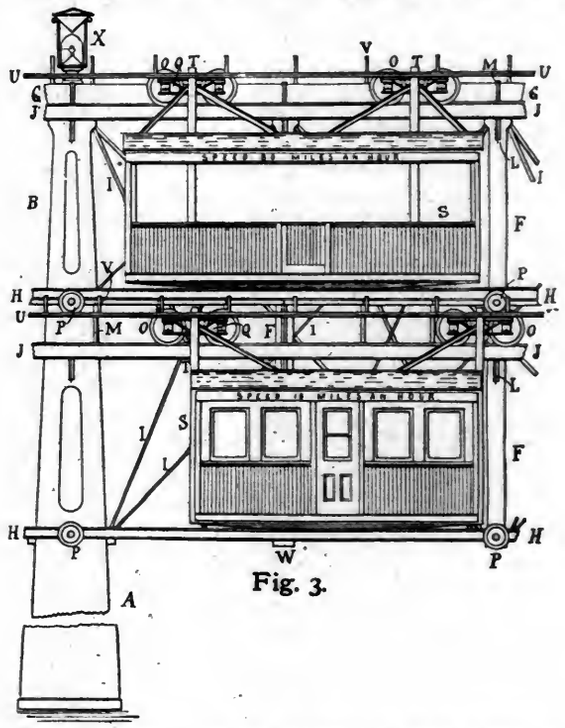


Fig. 3.

HALE'S PENDANT-CAR ELEVATED-RAILWAY SYSTEM.

the top chord or main truss by the braces V, the guards U, being just outside of the truck Q, and parallel to the rails J, in order to keep the wheels O, of the truck from getting off the track. Below the rails check-pins or stops *m*, are secured to the truck-hangers, so as to keep the wheels from jumping in case rails are irregular or the cars obstructed. The cars S, being pendant or suspended from the rails above, are prevented from being swung sidewise by the wind, or otherwise too much deflected from a perpendicular while in motion by a roller or small wheel N, fixed to the under side of the car, and on the edge running nearest to the main truss. The rollers N, runs

the guide H, this guide constituting the main tie or bottom chord of the vertical truss above described, and thus a double use is made of the guides H—viz., they serving as a tie for the truss, and a guide to limit the side movements of the cars, making them run very steadily.

In Fig. 1 is shown the guides H, and a single roller N, on the car, to run between them; but for short spans a single guide may be used on each side of the struts in place of the two guides and two rollers, one on each side of the guide in place of the single roller running between the double guides H. For a four-line railway—such as is shown in Figs. 2 and 3—one set of these guides H, will be secured to the central part of the struts F, in the vertical truss above described. To the bottom chord of the truss or the guides H, are secured pulleys P, over which runs the cable *p*, it moving on one side of the truss and returning on the other, and carrying the two lines of cars in opposite directions.

The cars are secured to the cable by grapples, which are to be on the under side of the cars and operated from within the same.

In carrying out the invention with two tiers or four lines of cars, as shown in Figs. 2 and 3, it is only required to make the posts and truss higher, attach the cross-arms K K, for sustaining the rails J J, for the upper and lower tiers of cars, and the cross-sills W and W, for sustaining the guides H H, for the upper and lower tiers of cars to the posts or struts, as shown, and make all of the parts proportionally larger, according to the increased weight to be carried.

In the several views are represented electric lamps X, applied on the top extensions of the supporting-posts. These lamps may be used in connection with wires and storage-batteries to be supplied by dynamo-electric machines run by the cable-engines, or otherwise, at the several stations, for the purpose of lighting the railway at night.

It is claimed for this form of elevated railway that its several and novel features attain a result which gives strength of construction, and easy handling, combined with all those features essential to the full solution of the rapid-transit problem.

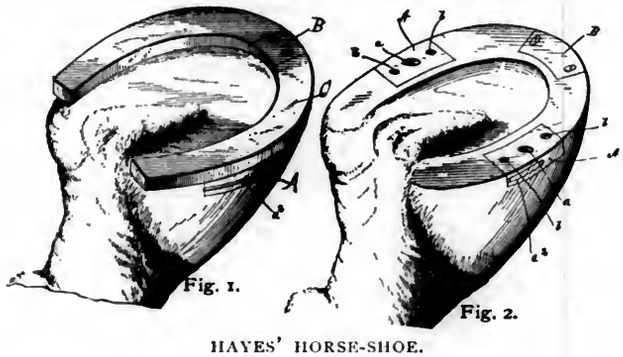
Inquiries and communications should be addressed to Mr. James Frame, secretary and treasurer, the Elevated Cable Railway Company, Burlington, Iowa.

Hayes's Horse-Shoe.

CHARLES W. HAYES, of Washington, D. C., is the inventor of a new and improved form of horse-shoe, which is herewith illustrated and described. The object of this invention is more particularly to provide a shoe and devices for connecting the same to the hoof, that the shoe may be quickly and firmly secured in position on the hoof without the use of nails or other permanent fastenings; it being adapted to be as quickly removed when desired.

In the accompanying cuts, Fig. 1 is a perspective view of an inverted hoof having the improved shoe applied thereto; Fig. 2 a like view showing the shoe removed, and illustrating the arrangement of the fastening-plates; Fig. 3 a perspective view of the upper side of the shoe; Fig. 4 a side elevation, partly in section, of a hoof with the improved shoe; Figs. 5 and 6 perspective views of the side and toe plates; Fig. 7 a transverse section of Fig. 5, and Fig. 8 is a perspective view illustrating the construction of the toe-clamps.

The under face of the wall or crust of the hoof at the point known as the "quarters" is provided with a recess at each side, each of which recesses is of such depth and shape as to adapt it to snugly receive and contain one of the plates A, which, as seen in Fig. 2, contracts toward the center of the foot. Each of the plates A, is provided with a central opening *a*, which is countersunk on the bottom face of plate. At either side of the opening *a*, are arranged holes *b b*, through which nails are driven to firmly secure the plate to the wall or crust. On the outer

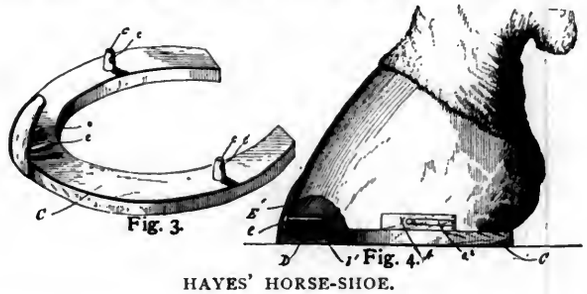


HAYES' HORSE-SHOE.

edge face of each plate A, and extending from one end to slightly beyond the center of such edge, is a longitudinal depression, the inner end of which is intersected by a conical opening *a'*, which also communicates with the opening *a*. Within the said depression is located a spring a^2, which is secured at its outer end by a rivet, while its inner end carries a conical pin a^3, which plays through the opening *a'*, and transversely across the opening *a*.

B refers to a plate, which is to be located at the toe of the hoof, and is secured thereat in a recess therein by nails, substantially the same as the plates A. The plate B, however, in addition to its nail-holes, is provided with two horizontal openings *b' b'*, as shown most clearly in Figs. 4 and 6.

The shoe C, which may be of any preferred form, is



HAYES' HORSE-SHOE.

provided at each side at the point which registers with the plates A A, with an upwardly-projecting lug *c*, Fig. 3, which lug is of conical form and adapted to enter the opening *a*, in the plate A. Each lug *c*, has an opening *c'*, passing horizontally through the same.

The shoe C, is recessed on its under side at the toe, for the reception of the horizontal portion or base D, of a toe-clamp E, Figs. 4 and 8, the base D, being provided with two openings *d d*, through which pass screws to secure the clamp E, rigidly to the shoe. It will be noted by reference to Fig. 1, that the base D, is flush with the under

face of the shoe. Extending rearwardly from the curved portion E′, of the toe-clamp are two horizontal pins *e e*.

In practice the toe-clamp E, is secured to the shoe, as before explained, and the shoe manipulated so that the pins *e e*, enter the openings *b′ b′*, to permit the curved part E′, to bear firmly against the front or toe portion of the hoof. The shoe is then forced up against the bearing on the under side of the wall or crust, thereby causing the lugs *c*, to enter the openings *b′ b′*, in the plates A, the conical form of said lugs resulting in pushing aside the pins a^3, until the openings in said lugs come opposite the openings *a′*, in the plates, when the springs a^2, project the pins a^2, through the openings in the lugs and lock the latter, with the shoe, firmly to the hoof.

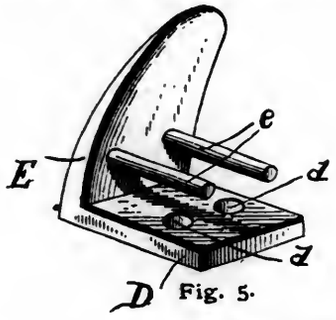


Fig. 5.

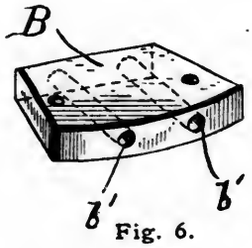


Fig. 6.

HAYES' HORSE-SHOE.

It will be noted that the length of the pins *e e*, is relatively much greater than that of the other pins and parts; but this is amply provided for from the fact that the wall or crust of the hoof is greatest both in thickness and in height at the toe of the hoof, consequently a greater bearing is afforded for the fastening devices at such point, which is the place where the greatest strain is received. Moreover, the strain or tension on the shoe is received by the latter in substantially a horizontal direction, thus serving, in this arrangement, to more effectively hold the plate and shoe together, which would not be the case if the power or force were in vertical direction. In the latter event the effect would be to tear or rend the shoe from the plates A A, and B.

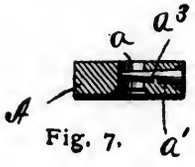


Fig. 7.

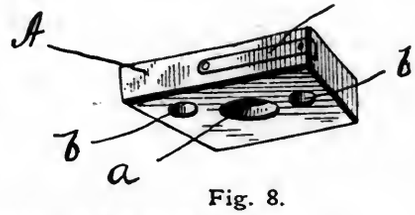


Fig. 8.

HAYES' HORSE-SHOE.

When it is desired to remove the shoe, it will only be necessary to raise the springs a^2, so as to lift or move their free ends out of their recesses, causing the pins a^3, to be withdrawn from the lugs, and then finally disengaging the toe-clamps from the plate B.

As the natural tendency of the wall or crust is to grow laterally, it will only be necessary to occasionally rasp the outer face of the crust in order to preserve the outer edge of the plates flush with said crust.

It is claimed by the inventor that the numerous disadvantages incident to the use of the ordinary form of horse-shoe, are by his device entirely obviated, while many new and valuable features are attained thereby. The great injury inseparable from the driving of nails into the hoof is avoided, while the wear is much less, as the shoes can be readily removed when not in actual use.

Another valuable feature of this device is that it allows a free expansion of the hoof when desired; and heavy or light, sharp or smooth sets can be kept at hand, and applied in a few moments, as circumstances may demand.

The invention is under the sole control of the patentee, Charles W. Hayes, Firemen's Insurance Building, Washington, D. C., to whom all inquiries and communications should be addressed.

Krantz's Crank-Pin Oiler.

FREDERICH W. KRANTZ, of Detroit, Mich., is the inventor of an improved crank-pin oiler, the construction and operation of which are shown in the accompanying cuts. Fig. 1 is a perspective view of the device as applied to a crank-pin; Fig. 2 a vertical central section of the oiler, and Fig. 3 a horizontal section on the line *x x* of Fig. 2.

A indicates the glass shell or cylinder, of suitable size. From the bottom of the metallic base of this shell a neck *b*, extends downward, which is suitably threaded to enter the socket mentioned. Within the shell there rises a central stem B, which is in effect, and may be in reality a continuation of the neck *b*, this stem extending to within a short distance of the top of the shell A, and terminating in a broad disk C, preferably convex on its upper face, as shown in Fig. 2. The stem B, is formed with a central hole or passage *c*, which extends from the top of the stem and its disk C, down through the neck *b*, and to the lower extremity thereof, as shown in Fig. 2.

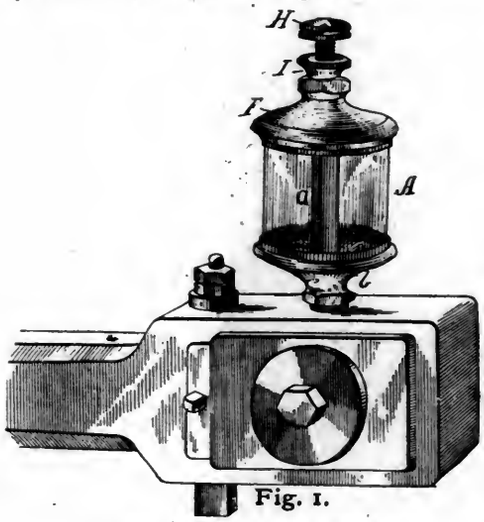


Fig. 1.

KRANTZ'S CRANK-PIN OILER.

F indicates the cap or cover of the oiler, formed with a depending flange or rim threaded on its interior to screw upon the threaded upper end of shell A. The inner or under face of the cap F, is turned flat and true, and bears upon a packing-ring G, which rests upon the upper end of the glass shell A.

Thus constructed, the parts are put together in the manner stated—that is to say, with packing-ring E, resting upon the base or bottom of the shell A, the packing-ring G, lying upon the upper end of the cylinder D, and the cap or cover F, resting upon the packing-ring G. The cap is then screwed firmly upon the shell A, and the

several parts are brought together so snugly and closely as to produce tight joints and prevent the escape of oil. The cap or cover F, has a central hole or opening through it, which is threaded to receive a filler-plug, above which is located a lock-nut I, which filler-plug and lock-nut, also have a hole or opening, which is threaded to receive a valve or pointed screw-stem H, the point or nose of which enters the upper end of the passage *c*, as the stem is screwed down, and serves to close the mouth of this passage more or less, as required.

D D are nut-holes bored through the cap F, at a point close to the edge of and immediately under the seat of filler-plug, so that when the oil is poured into the cylinder B, the air is permitted to escape through these vents, thereby causing the cap to fill rapidly. Replacing the filler-plug closes the vents, so that opening and closing of vents D D, is simultaneous with the opening and closing of the filler-plug.

The device being thus constructed is applied to a pitman or other part attached to a crank-pin and partaking of the motion thereof, or to any other moving part requiring to be oiled. The throw of the crank-pin being

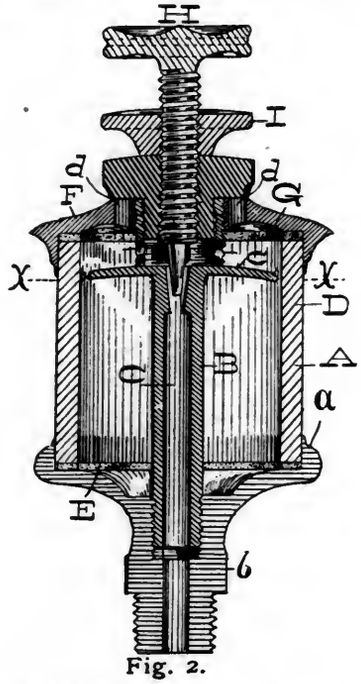


Fig. 2.

KRANTZ'S CRANK-PIN OILER.

quick and sudden, the oil with which the cylinder is supplied is thrown upward into the top of the cylinder as the crank-pin and oiler descend, and is caused to pass around and over the top of the disk and the portion of the stem H, below the cap or cover. The oil, flowing down the stem and across the mouth of the passage *c*, finds its way into the passage and through the same down to the crank-pin to be oiled. A moderate speed or motion is sufficient to cause the oil to be thrown to the top of the cylinder and over the disk C, so that a quantity of oil sufficient to supply the requirements of the part to be oiled will run down through the stem to this part; but as the speed increases the centrifugal force, if the oiler be applied to a crank-pin or other part having a circular path of movement, or the inertia, if the oiler be applied to a reciprocating body, will be increased exactly in proportion to the increase of speed or motion. This increase of force with which the oil is thrown into the top of the cylinder creates a pressure by reason of which the oil is forced through the passage *c*, of the stem B, instead of being left to flow down by gravity allone. It will therefore be seen that just in proportion to the increase of speed or motion, and consequent need of more oil, the supply of oil to the moving part is increased, or, in other words, the supply of oil delivered to the working-surfaces automatically increases and diminishes with and by reason of the increase and diminution of speed or motion. As the oil is thrown upward by the motion of the oiler it encounters the disk, and is by it directed outward to the walls of the oil-chamber, whence it passes above the disk. In this way the oil above the disk is forced toward the center, and consequently carried with certainty and under pressure to the outlet through the tubular stem. By setting the stem H, higher or lower, as required, the mouth of the passage *c*, may be opened or closed to any required extent, and the flow of oil to the crank-pin thus regulated with the greatest nicety. The screw or valve-stem, after being once set or

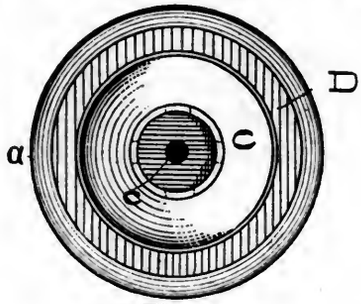


Fig. 3.

KRANTZ'S CRANK-PIN OILER.

adjusted seldom requires to be re-set, and in many places never requires further adjustment, as in refilling the cup the adjustment is not disturbed, the valve H, being held in position by lock-nut I.

It will be seen that when the machinery is at rest no oil can pass from the cylinder and hence none is wasted; nor is the machine made dirty and caused to collect dust and dirt by reason of an oversupply of oil and consequent flowing out of the same around the crank-pin.

The glass cylinder is used for stationary engines, and generally where the machinery is protected against extreme cold weather, or where there is little or no danger of breakage of the glass; but for locomotives and like machinery the glass is encased in brass shells, or the shell is made entirely of brass, and the base is constructed flat, with round or hectagon edges.

This device is claimed by the inventor to be simple, durable and economical. It is now entirely controlled by the Michigan Lubricator Company, of Detroit, Mich,, to whom the patent-rights have been assigned.

McNiece's Lubricator.

THOMAS B. MCNIECE, of Detroit, Mich., is the inventor of an improved lubricator, which is herewith illustrated and described. The invention belongs to that class of lubricators which are used for oiling the cylinders and and valves of steam-engines, and in which the oil is expelled from a chamber by the pressure of a column of water, which gradually displaces the oil as the water flows into the oil-chamber beneath the oil.

In the accompanying cuts, Fig. 1 is an elevation of the improved lubricator; Fig. 2 a vertical central section; Fig. 3 a vertical central section made on a plane at right angles to that shown in Fig. 2; Fig. 4 a sectional view showing the air-vent; Fig. 5 a modified and portable form of the device, intended for use on air-brake mechanism, etc., and Fig. 6 a vertical central section showing manner of attachment of the feed-regulator and sight feed-glass to the escape-pipe *f*.

A is the oil-chamber, B is the condenser or water-chamber, L′ the union connecting with, and for the purpose of introducing steam into the condenser B; C is a tubular arm by which the apparatus is attached to the steam-pipe. The water of condensation flows down through the pipe D, which delivers it at the bottom of the oil-chamber. In the neck which connects the oil and water-chambers is a diaphragm D′, shown in Fig. 3, with

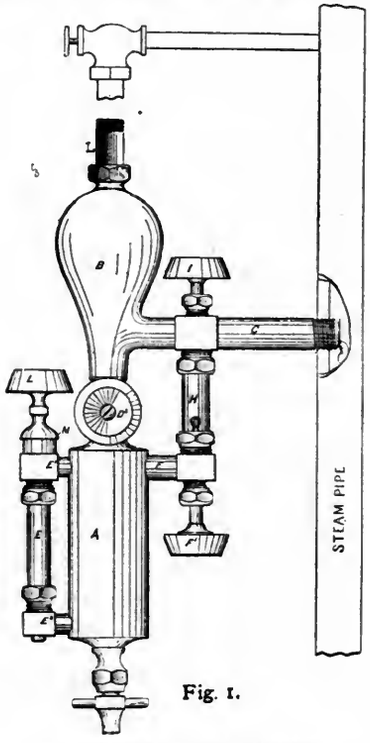


Fig. 1.

MC NIECE'S LUBRICATOR.

a hole for the downflow of the water, the sides of which form a seat for the valve D^2, by the adjustment of which the passage of water can be cut off or regulated, so as to control the discharge of oil. As water descends into the oil-chamber and displaces the oil, the amount of displacement can be seen through the transparent tube E, which is connected at E′ and E^2, with the interior of the oil-chamber. As the oil is displaced by the water, it will flow out of the escape-pipe F, its flow being regulated or prevented by the valve F′, which acts against a valve-seat in the orifice of discharge in the upper part of the pipe F. The oil in escaping passes through the nipple G, which is inclosed in the transparent tube H. This tube H, being in communication with the steam-pipe or chamber through the duct C^3, when the valve I, is opened, will be filled with steam at first, and then with water, the product of the condensation of the steam, through which the oil, rising from the nipple G, drop by drop, will be visible. In the lower end of the oil-tube is placed a valve K, having a port K′, through which the entire contents of the apparatus may be drained. Another form of valve or a mere stop-cock or plug may be used for the purpose of the valve K. This arrangement of the different chambers so that they all drain into the oil-chamber, and thus permit their discharge at a single vent, is peculiar to this instrument. While the water-chamber B, and sight-feed tube H, receive their steam to be condensed indepen-

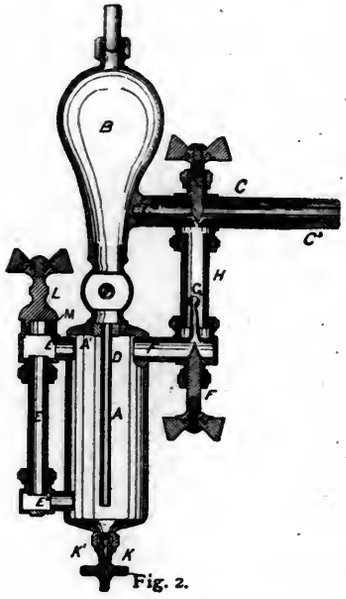


Fig. 2.

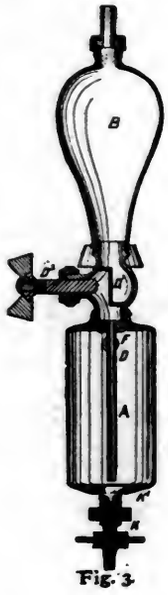


Fig. 3.

MC NIECE'S LUBRICATOR.

dently, they have the same channel through which their contents can be discharged. Heretofore separate passages, each provided with a screw cap or plug, have been usually required to fill the oil-chamber and vent the air contained therein, but, in order to simplify and do away with the extra plug, an air-vent A′, is bored in the shell of the oil-chamber, as shown in Fig. 2, and more clearly in Fig. 4. As this air-vent terminates in the upper edge

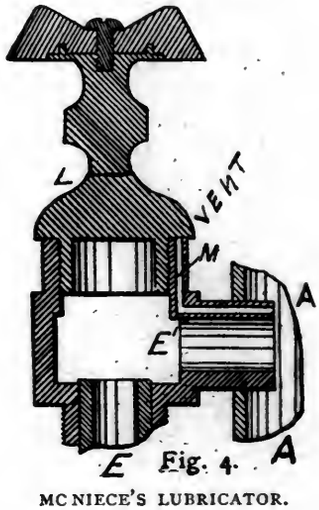


Fig. 4.

MC NIECE'S LUBRICATOR.

of the filler-tube, the air escapes as rapidly the oil is poured into the mouth of the filler E′, causing the cup to fill rapidly. When the filler-plug L, is replaced, its shoulder closes the air-vent, consequently when the plug L, is screwed out, the air-vent opens simultaneously.

Too much stress cannot be placed upon the importance of this vent, which is peculiar to this cup only, as one of the greatest sources of annoyance to engineers is the

necessary time wasted on the slow process of filling imperfectly vented cups.

Another desirable feature pertaining to these lubricators is the construction of the arm F, which permits the sight feed-glass to be easily taken out and replaced, as shown in Fig. 6, and is described as follows: *f* is the arm or escape-pipe to which the lubricator is attached by means of a threaded screw running through the cross-end of the arm, the regulating nipple playing in the screw by another thread which allows of the proper regulating action. This screw, with all of the regulating attach-

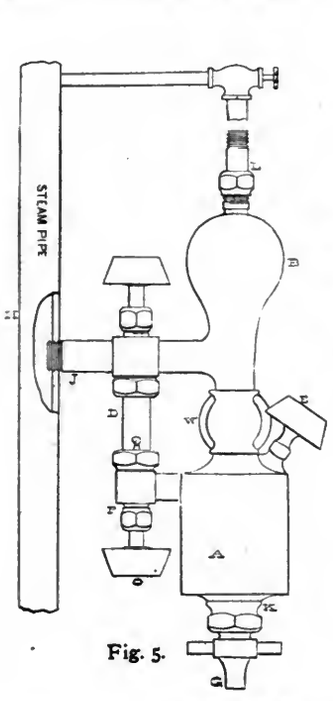


Fig. 5.

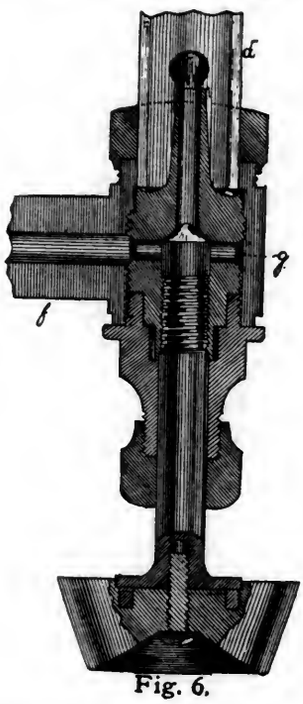


Fig. 6.

MCNIECE'S LUBRICATOR.

ments, can be withdrawn from their threaded construction, thus allowing the sight feed-glass *d*, to be readily taken out and replaced.

In the modified form of the device shown in Fig. 5, there is no gauge-glass showing the amount of oil in the cup, and a heavy jam-nut is placed at the base of the cup for the purpose of making an unusually strong connection when applied to threshing-machine engines, or inside the cab of a locomotive for air-brake uses. The same style of jam-nut may also be employed in cups, shown in Fig. 1, when used in connection with air-brakes.

This device and its modification is entirely controlled by the Michigan Lubricator Company, of Detroit, Mich., to whom the inventor has assigned his patent-rights.

Elliott's Adjustable Car-Step.

FRANCIS E. ELLIOTT, of Columbus, Ohio, is the inventor of a new and improved form of car-step, which is herewith illustrated and described.

The invention relates to improvements in car-steps, the object being to provide an adjustable step having its frame journaled at the ends upon the fixed step of the car, so that it can be folded up thereon and be out of the way when the use of the fixed step alone is required. By the use of this step the danger and inconvenience to travelers while getting off and on trains are largely diminished.

In the accompanying cuts, Fig. 1 represents a perspective view of the invention attached to the fixed steps of a car, and Fig. 2 a sectional view showing the way in which the movable step is turned up on the fixed step.

A designates an end of a car having the platform A', attached, which is provided with the usual railing and other fixtures, as shown. These, however, form no part of the invention, and are therefore not described.

B is a fixed step depending from one side of the platform, and composed of the two vertical parts *b b'*, and the two horizontal parts, b^2 b^3. At or near each end of the outer edge of the part b^3, is secured by bolts or in other proper manner a plate C, which rests in a recess in the part b^3, so as to be flush with the upper surface thereof. Each of these plates has a similar upright *c*, of suitable form, which is provided with a journal-pin *c'*, the two journal-pins having bearings in the ends of the frame of the movable step hereinafter described.

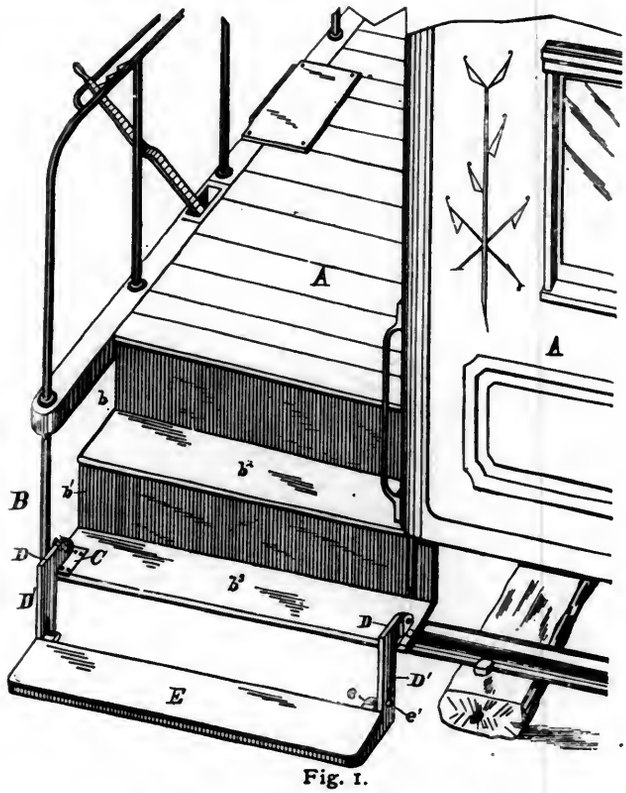


Fig. 1.

ELLIOTT'S ADJUSTABLE CAR-STEP.

D is the frame, composed of the end angle-irons D', and the connecting iron or brace D^2, which has its ends bolted or riveted to the ends of the angle-irons. Each angle-iron is composed of the two horizontal parts *d d'*, respectively, and the central vertical part d^2, provided near its lower end with a longitudinal slot d^3. The part *d*, has near its inner end a proper opening for the journal-pin *c'*, to enter, so that the angle irons and their brace D^2 can be turned over on the fixed step in the position shown in full lines in Fig. 2, the parts being constructed of relative dimensions to permit this movement.

The part *d*, of each angle-iron has on its edge a projection *x*, which enters a corresponding recess in the part b^3, of the step, and prevents lateral motion of the movable step when turned down. The parts *d*, have a length just a little less than one-half the breadth of the part b^3, of the step B, and the standards *c*, are so situated that

when the angle-irons are turned down, the edges of the parts d^2, will rest against the edge of the part b^3, of the fixed step. Consequently when the angle-irons are turned up there will be a narrow space between their parts d^2, and the part b', of the fixed step.

E is the foot-board of the movable step, of proper dimensions to lie upon the lower part of its frame with its edges resting upon the brace or connecting iron D^2, and the parts d', of the angle-irons.

e are projections which stand inward from the inner edge of the foot-board near the ends thereof. When the foot-board is in position, these projections incline slightly upward, each projection having a journal-pin e', which enters one of the slots d^3, and is prevented from escaping therefrom by a nut on its outer end.

When the movable step is turned down, the parts assume the position shown in dotted lines in Fig. 2, except that the foot-board is in the position shown in Fig. 1. When the movable step is turned up, the parts assume

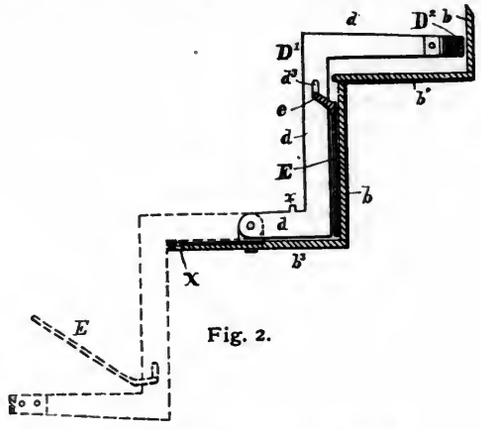


Fig. 2.

ELLIOTT'S ADJUSTABLE CAR-STEP.

the position shown in full lines, Fig. 2, the foot-board standing between the parts d^2, of the angle-irons and the part b, of the fixed step. The pins e', also fall in the slots d, so that the lower edge of the foot-board may rest upon the fixed step and be in a more stable position.

It is claimed for this form of step that it is applicable to any style of step now in use on passenger cars in the United States, and is a great convenience, to say nothing of the increased safety to ladies and children when getting on or off the car. When not in use the step is always folded up and kept in that position by its own weight. A brakeman standing at the forward end of the train can easily fold up all the steps on one side of the train, by simply taking hold of the frame of the adjustable step as the car passes him, and with a slight motion of the hand throw the step and frame into the proper position.

The device is under the sole control of the inventor, to whom all communications should be addressed.

Kramer's Leveling Apparatus for Steam-Boilers.

JOHN M. KRAMER, of Maria Stein, Ohio, is the inventor of a new and improved form of leveling apparatus for steam-boilers, which is herewith illustrated and described.

The object of this invention is to provide a new and improved apparatus for leveling boilers automatically, and consists of a pendulum provided with arms which operate valves, of a cylinder which is connected by a pipe with the water-compartment of the boiler, and of a device for regulating the movement of the pendulum.

In the accompanying cuts Fig. 1 is a side elevation, partly in section, of the improvement attached to a portable boiler standing on a level. Fig. 2 is a similar view of the improvement attached to a portable boiler passing down an incline. Fig. 3 is a like view attached to a portable boiler going up an incline; Fig. 4 a sectional elevation of a modification of the pendulum-regulating device; Fig. 5 a sectional side elevation showing the mounting of the

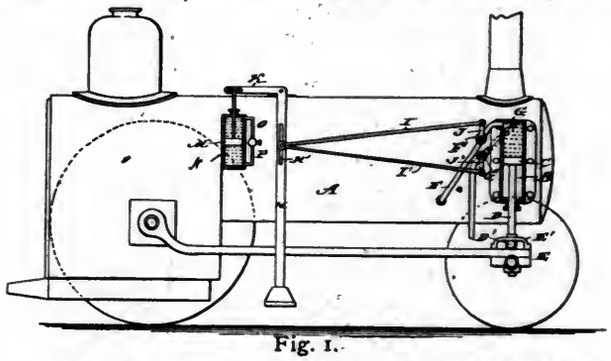


Fig. 1.

KRAMER'S LEVELING APPARATUS FOR STEAM-BOILERS.

pendulum; and Figs. 6 and 7 are detail sectional views showing the position of the valves in the pipes.

The boiler A, of usual construction, is provided on one end with one or two cylinders B, having a piston C, to which is attached a piston-rod D. The lower end of the piston-rod D, is provided with a roller D', which rests on a guide E', attached to the bolster E. of the truck of the boiler. The front end of the boiler A, is thereby supported on the fixed piston C. The upper end of the cylinder B, above the piston C, connects, by the pipe F, with the water-compartment of the boiler A, and another pipe G, which leads from the upper end of the cylinder B, to the open air, but may lead to a tank or other suitable

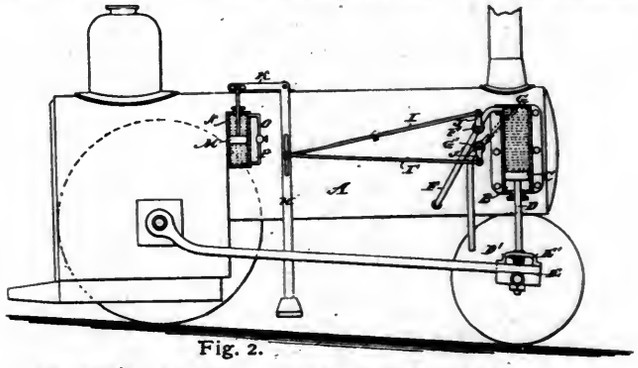


Fig. 2.

KRAMER'S LEVELING APPARATUS FOR STEAM-BOILERS.

receptacle, or to a pump which connects with the boiler. The pipes F, and G, are each provided with a valve F' or G', respectively.

The pendulum H, is mounted on the top of the boiler A, preferably in the manner as shown in Fig. 5. The pendulum hangs free on the side of the boiler A, and is provided with a slot H'. To the pendulum H, are pivotally attached and adjustable in the slot H', the arms I, and I', which connect with the levers J, and J', operating the valves F', and G', respectively. The upper end of the pendulum H, is also provided with a rigid arm K, to the outer end of which is pivotally attached the piston-rod L,

provided with the piston M, working in the small cylinder N, fastened in any suitable manner to the boiler A, and filled above and below the piston M, with either oil, air, water, or other suitable substance. The upper and lower ends of the cylinder N, are connected with each other by the pipe O, provided with a valve or cock P.

A communication between the upper and lower ends of the cylinder N, can be established in the manner shown in Fig. 4, in which the piston-rod L′, is hollow and provided with the transverse opening L^2, above the piston M′, and an adjustable rod or plunger Q. placed in the hollow piston-rod L′, serves to close or open the transverse openings L′, thereby connecting or disconnecting

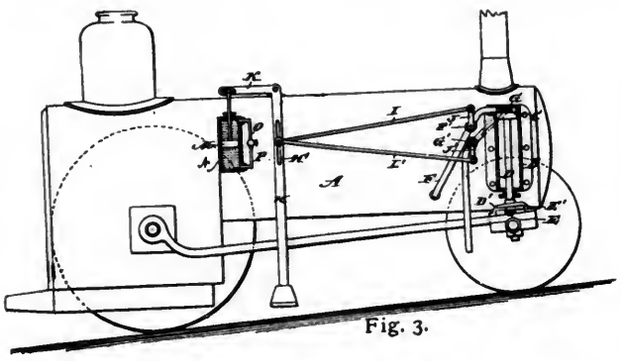


Fig. 3.

KRAMER'S LEVELING APPARATUS FOR STEAM-BOILERS.

the upper and lower ends of the cylinder N, and also regulating the flow of the substance in the cylinder N, from one end to the other when the piston M′, is raised or depressed.

The operation of the device is as follows: When the boiler A, is in the normal horizontal position, as shown in Fig. 1, the valves F, and G, are both closed and the cylinders B, are filled with water above the piston C, which is then in a midway position. When the truck passes down an incline as shown in Fig. 2, the pendulum H, assumes an inclined position to the center line of the boiler A, and swin s to the right, thereby opening the valve F′, by means of the arm I, and the lever J, so as to

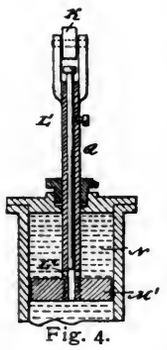


Fig. 4.

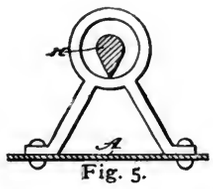


Fig. 5.

KRAMER'S LEVELING APPARATUS FOR STEAM-BOILERS.

admit water under pressure in the boiler from the same into the cylinder B, by means of the pipe F, and thereby forcing the cylinder B, and the front end of the boiler E, upward (the boiler being adapted to move vertically on its rear axle as a pivot), until the pendulum and the boiler are again in the normal position and the valve F, is again closed. During the time that the valve F′, is opened and closed again the valve G, remains closed, although moving. As soon as the truck reaches a horizontal position again, the pendulum H, swings to the left, whereby the valve G′, is opened, and the water which had been admitted into the cylinder B, is forced out of the same through the pipe G, until the piston reaches its normal position (shown in Fig. 1) and the pendulum also has returned to its normal position and has closed both of the valves F′, and G′. When the truck passes up an incline, as shown in Fig. 3, the pendulum swings to the left, thereby opening the valve G, by means of the arm I′, and the lever J′. The weight of the front end of the boiler causes the water above the piston C, to flow out by means of the pipe G, and the open valve G′, so that the boiler with its front end swings downward until the pendulum and the boiler are again in the normal position and the valve closes, while the valve F′, comes back to its normal position. When the truck reaches a horizontal position, the pendulum H, is swung to the right so as to open the valve F′, and thereby admit water under pressure from the boiler to force the piston C, in the cylinder B, downward until it reaches its normal position (shown in Fig. 1), and at the same time the pendulum will assume the normal position and close both valves F′, and G′.

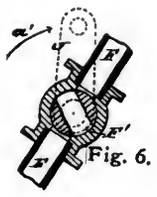


Fig. 6.

Fig. 7.

KRAMER'S LEVELING APPARATUS FOR STEAM-BOILERS.

It will be seen by reference to Figs. 6 and 7 that the valves F′, and G′, are so arranged that when the arms I, and I′, move in the direction of the arrow *a′*, the valve F′, is opened, while the valve G′, remains closed, although moving, and when the arms I, and I′, move in the direction of the arrow *b′*, the valve G′, is opened and the valve F′, remains closed, although moving.

It will be seen that as the pendulum H, assumes a vertical position while the boiler A, is inclined, the piston M, changes its position in the cylinder N, which change is regulated by the speed with which the substance in the cylinder N, flows from one end of the cylinder N, to the other by means of the connecting-pipe O, and the valve P. If the valve P, is closed entirely, so that there is no connection between the ends of the cylinder N, then the piston M, and the pendulum H, are prevented from moving.

Any suitable device for compensating for leakage in the cylinder N, may be used.

It is claimed for this device that it is thoroughly effective, and specially adapted for use on traction or road-engines, locomotives, or ships, and all forms of engines where the boilers will from time to time change their position from a horizontal plane. With road-engines it will keep the boiler horizontal going either up or down hill, as also with locomotives on grades, and rolling or pitching vessels.

The invention is under the control of the inventor, to whom all inquiries and communications should be addressed.

Adamson's Safety-Switch.

ROBERT ADAMSON, of Auburn, N. Y., is the inventor of an improved form of safety-switch, the construction and operation of which are herewith illustrated and described. This invention relates to the construction of a mechanism whereby the switch-rails are automatically moved into alignment with the rails of the main track by an approaching train, the object of the invention being to provide a safety-switch for trains passing on the main track; and to this end the invention consists of sliding blocks mounted to slide in inclined ways connected by rods and chains with a chain-wheel which carries a pinion that engages with a gear-wheel, to the shaft of which the switch-lever is rigidly secured, and of certain other novel constructions and combinations, hereinafter explained and specially pointed out.

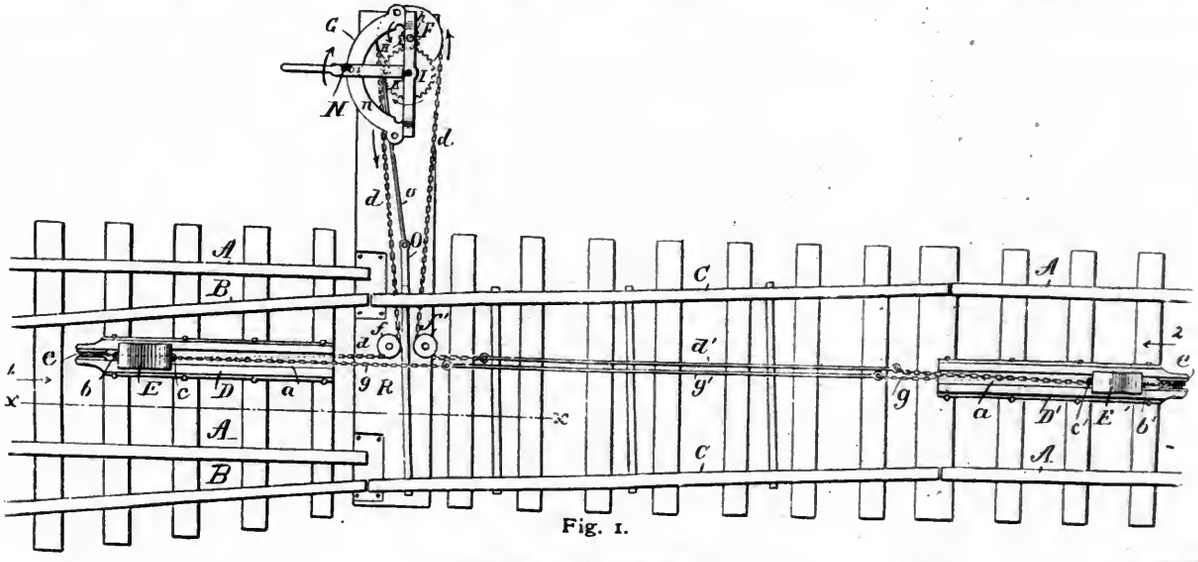


Fig. 1.

ADAMSON'S SAFEFY-SWITCH.

In the accompanying cuts, Fig. 1 is a plan view of the switch and the improved operating mechanism; Fig. 2 a side sectional view taken on line *x x* in Fig. 1, showing the slide and a portion of the pilot of an engine approaching the switch; Fig. 3 a view of the under side of the pilot of the engine; Fig. 4 a perspective view illustrating

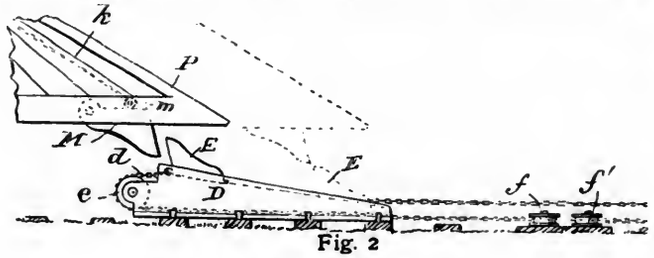


Fig. 2

ADAMSON'S SAFETY-SWITCH.

in detail the construction of the block and inclined slide; Fig. 5 a perspective view illustrating the construction of the switch-stand; Fig. 6 a detail view of the switching-lever and its yielding roller-catch; Fig. 7 a view of the arrangement for a double switch; Fig. 8 a view of the double pin-carrying attachment used with the double switch, and Fig. 9 a modification of the construction shown in Fig. 6.

A A represent the main line or track, and B B the cross-rails to the siding, which are reached by the switching-rails C C. Two inclined ways D D', are securely fastened to the ties in the center of the track beyond the ends of the switching-rails. A dovetailed groove *a*, is formed in the upper inclined face of each of these ways D D', and in these grooves blocks E E', are fitted to slide up and down, the construction of the way and said blocks being best shown in Fig. 4. The blocks E E', are provided with eyes *b c*, and *b' c'*, respectively, and to the eye *b*, of the block E, there is attached a chain *d*, which passes from the eye over a sheave *e*, carried by the block D then along the center of the track to a sheave *f*, which is secured to the heavy tie or timber R, supporting the ends of the rails A A, and B B, thence to and partially around a chain-wheel F, that is carried by the switch-stand G, and back to a sheave *f'*, located near the sheave *f*, and on the eye *c'*, of the block E, he connection between the parts *f'* and *c'*, being made by a rod *d'*, if desired. A second chain *g*, is secured to the eye *b'*, of the block E', and passes over a sheave *e'*, placed in the way D, to correspond with the sheave *e*. After passing over the sheave *e'*, the chain *g*, leads directly to the eye *c*, of the block E,

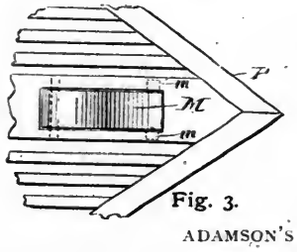


Fig. 3.

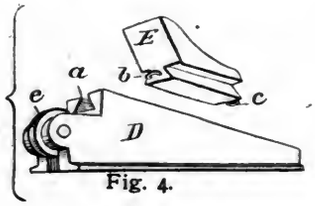


Fig. 4.

ADAMSON'S SAFETY-SWITCH.

or the rod *g'*, may be substituted for part of the chain, if desired. The chain-wheel F, is fast upon the vertical shaft *k*, which is mounted in the switch-stand G, which said shaft carries a pinion H, that meshes with a gear I, on the shaft K, to which the switching-lever N, is rigidly secured. The switch-bar O, is connected to the gear-wheel I, by means of a rod *o*, which is pivotally connected to both the bar O, and the gear I. A dog or catch M, is pivotally connected to the under side of the pilot P, and normally hangs below the pilot, as shown best in Fig. 2, but, if desired, this dog M, may be raised above the bottom of the pilot by means of a chain *k*, which leads over properly-arranged sheaves to a pull, or lever located in

the cab of the engine. Lugs *m*, on the sides of the dog M, engage with the pilot frame and prevent the dog from projecting too far.

The operation is as follows: If a train is approaching in the direction of the arrow marked 1, and the switch is set for the siding, as indicated, the dog M, will strike the block E, and move it to the position indicated in dotted lines in Fig. 2. This movement of the block E, will draw the chain *d*, in the direction of the arrow shown in connection therewith, and the chain-wheel F, will consequently be revolved in the direction of its arrow, carrying the pinion H, forward in the same direction, which movement of the pinion will move the gear I, in the direction indicated, thus retracting the rod *o*, and thereby drawing the switch-bar O, over, to bring the switching-rails in conjunction with the main rails A A, thereby establishing the way for the train to pass on down the main line over the switch-rails. If the train is approaching in the direction of the arrow No. 2, it will strike the block E', which, in moving down the slide or way D', will retract the chain

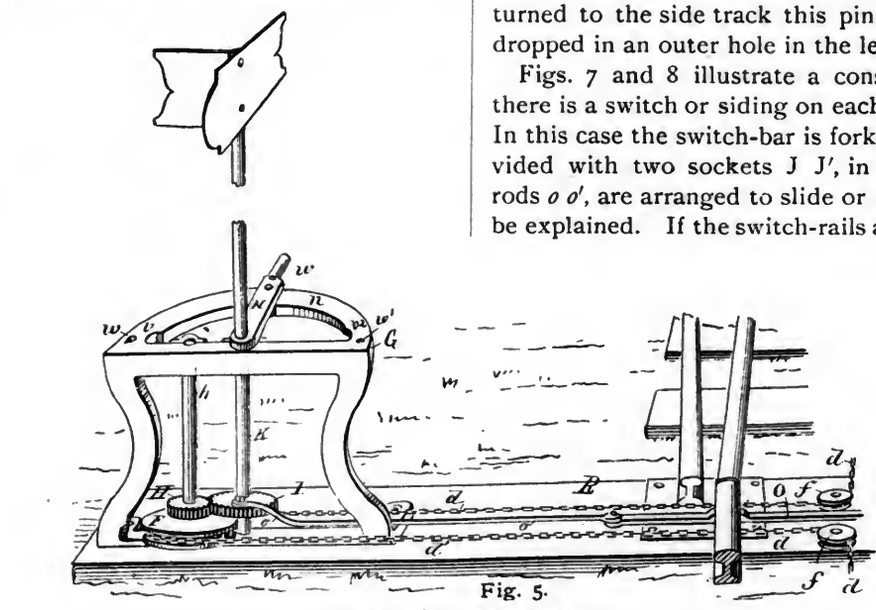


Fig. 5.

ADAMSON'S SAFETY-SWITCH.

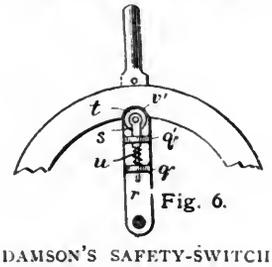


Fig. 6.

ADAMSON'S SAFETY-SWITCH.

g, and consequently draw down the block E, and the drawing down of the block E, will move the switch-rails C C, as before described. The switch-lever N, rides above a circular rack *n*, which projects from one side of the switch-stand G, and on the inner face of this rack there are formed three circular notches *v v' v²*, located in substantially the relative position shown. Upon the under side of the lever N, there are two lugs *q q'*, formed with apertures in which the shank *r*, of a block *s*, rides. The block *s*, carries a roller *t*, which is held against the rack *n*, by a spiral spring *u*, which abuts against a shoulder on the shank *r*, and against the lug *q*, so that as the lever is moved over one of the notches the roller *t*, will be forced outward to engage therewith, and will hold the lever in position against any ordinary strain, but will not resist the strain to which the parts are subjected when the chain-wheel F, is rotated by the movement of either of the blocks E E'. Ordinarily, when the main line is open for travel, the lever N, is locked in place by a pin, which is passed through the aperture *w*, and a corresponding aperture *w'*, formed in the rack *n*; but when the switch is turned to the side track this pin is not used, and can be dropped in an outer hole in the lever, out of the way.

Figs. 7 and 8 illustrate a construction for use where there is a switch or siding on each side of the main track. In this case the switch-bar is forked at its end, and provided with two sockets J J', in which two connecting-rods *o o'*, are arranged to slide or be held by pins, as will be explained. If the switch-rails and rails B, are in alignment, the rod *o*, is secured within the socket J, by means of a pin *i'*, so that as the gear I, is revolved in the direction of the arrow by the action of the pinion H, the switching-rails C C, will be drawn over in line with the main track. while if the switch-rails C C, are in line with the side rails B', the pin *i*, will hold the rod *o'*, within the socket J', and as the gear is revolved the switch-rails will be forced back

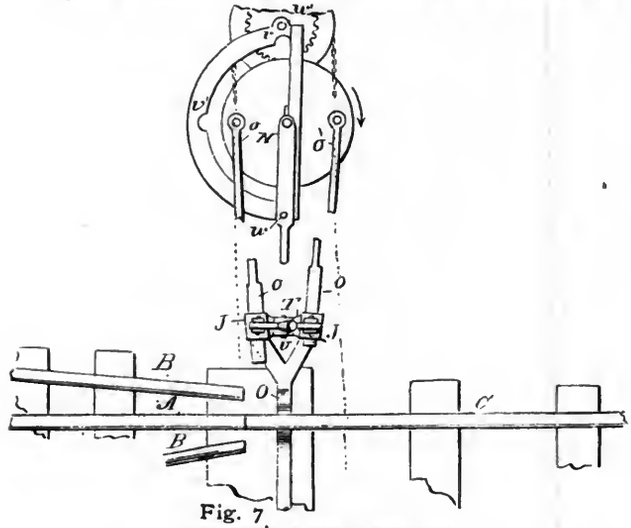


Fig. 7

ADAMSON'S SAFETY-SWITCH.

to the line of the main track. The pins *i i'*, are carried by a rocker T, formed with a handle U, and centrally pivoted in a standard V, fixed between the sockets J J', so that by simply turning the rocker one of the pins may be brought into use to hold its bar, while the other will be disengaged to allow its bar to slide within the socket.

The various parts are so arranged that when the switch-

rails are in line with the rails B B, the blocks E E′, will be at the top of the ways D D′; but when the main line is open—that is, when the switch-rails are in line with the

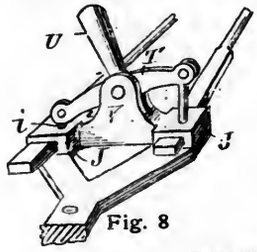


Fig. 8

Fig. 9.

ADAMSON'S SAFETY-SWITCH.

rails A A—the blocks will be at the lower portion of the slides. If the train is to run upon the siding, the dog M, is raised as the train approaches the switch, so as not to throw the switch to the main line.

Fig. 9 illustrates an attachment for the switch-lever by which the roller *t*, may be thrown out of engagement with the notches *v v′ v²*. It consists of a hand or thumb lever *t′*, pivotally connected to the switch-lever and provided with a lever-arm which engages with a pin on the block *s*, so that as the lever *t′*, is carried toward the lever N, the block *s*, will be depressed and the roller *t′*, relieved from engagement with the notch in which it rested.

The grooves in which the blocks E E′, are mounted are inclined, so that as the train advances the blocks will be carried below the level of the dog M.

It is claimed by the inventor that his device is a simple, durable, efficient, and economical form of safety-switch, which will satisfactorily and thoroughly answer to the requirements of this feature of railway construction.

GENERAL OFFICES THE ROTE AUTOMATIC BRAKE COMPANY,

MANSFIELD, OHIO, *November 3d, 1884.*

To the Westinghouse Air Brake Company, Pittsburgh, Pa.:

GENTLEMEN:—Understanding from your published announcements that you recommend your brake for freight-train use we respectfully invite you to a complete and searching public test of its merits in competition with the *Rote Automatic Brake* This test to be made in so complete and critical a manner as to show all the railroads of the country, as well as the Railroad Commissioners of the various States, which of the two brakes is the one which should be used; for the test will, we are certain, leave no doubt in the minds of any witnessing it.

To insure the proper management of the test we suggest that you choose one person, we another, and these two a third person, all three to be well known as capable and honorable rolling-stock experts, to conduct the test, their expenses to be jointly borne by you and by us.

An invitation to witness the test to be extended to the General Officers of Railroads and all State Railroad Commissioners to the members of the National Car-Builders Association, and to the Railroad and daily press.

The test to be at such time and place as may be mutually agreed upon, but we suggest that the proper place would be on some road having high grades and sharp curves, so that both brakes may have as hard and complete a test as possible. As it is necessary to make the test searching and complete, and as all railroads wish to increase the length of their trains and only wait for a brake which will enable them to do so, we think each train should be made up of 50, 60 or 70 cars, as you may prefer, or, if you think best, of even more cars.

Your company to supply your train and engines, we to supply ours.

The following points, among others, to be considered and reported upon:

Cost of equipping trains.

Simplicity.

Freedom from breakage.

Certainty of action.

Effectiveness.

Cost of maintaining.

"Flatting" of wheels.

Any other points submitted by you or by us in writing to be added to the above.

The brakes or trains are to be tested in every manner and under all conditions which practical railway service may suggest, including yard as well as line service.

Among others the following tests are to be applied to both trains:

1st.—Each train is to be (part of the time) run by engineers and crews who have never operated either brake and who are wholly unfamiliar with them.

2d.—The trains are (part of the time) to be partly made up (as nearly all freights are everywhere) of foreign cars, which have neither your nor our brake on, so that the cars having your break or ours on shall be widely and irregularly separated from each other.

3d.—The locomotives drawing your train and ours to be exchanged, from time to time, and draw each others trains.

4th.—Two locomotives equipped as so many freight engines and tenders are, with hand-brakes instead of steam or air brakes, are to be substituted for the two engines used in the test part of the time. Any brake which will not work properly if this is done, you will admit, can be of little practical value in actual service.

5th.—From time to time each train is to be stopped and foreign cars (not equipped with either your brake or ours) are to be run into it, at irregular intervals, just as actual service requires constantly.

6th.—In the making up of trains, etc., crews are to be exchanged at random, so that the test may fully illustrate the convenience of operating each kind of brake in actual ordinary service.

7th.—Frequent short runs, stops and quick starts are to be made.

8th.—A series of yard tests are to be made, showing the action, convenience, etc., of the two brakes.

We mention a few necessary tests only, and you and we, as well as the test committee, are to add any number of others, it being distinctly understood that if you decline any test proposed by us, or we decline any proposed by you, it shall be condered an explicit and positive admission of inferiority.

This rule must in every case be strictly observed, namely: *Both brakes must be tested in precisely the same manner*, so that there may not only be absolute fairness, but no room for suspicion even of anything else.

You have been in the brake field a long time, have profited justly and largely from the patronage of railroads, and we are sure will welcome this plan for allowing your patrons and the American public to judge for themselves which brake should come into universal use.

Having proper confidence in the merits of your brake we know you will gladly and promptly accept our proposition herein made, as you must feel that the test will be complete.

The railroad public is a very fair-minded, capable body, and will most horoughly appreciate and fully recognize the equity and fairness of our offer to you, and, in common with business-like people everywhere, will naturally (and, we are sure you will admit, properly) consider it a virtual confession of inferiority and a public admission that the Westinghouse Brake is inferior to the Rote Brake and that it is unfitted for general freight service, should you decline or neglect to avail yourselves of the proposition we make you herein.

Permit us to add in closing that we wish to express to you our desire to have this communication received in the spirit in which it is sent, and to have it express to you our wish for a full, fair and searching test of the two articles in the relative merits of which the railroad interest is *primary* and that of the owners even secondary. Respectfully,

THE ROTE AUTOMATIC BRAKE COMPANY,

Per M. D. HARTER, President.

American Railroad Journal.

WHOLE NO. 2,577.] NEW YORK, JUNE, 1886. [VOLUME LX.—NO. 3.

SELECTION AND PROMOTION OF RAILWAY EMPLOYES.

BY WM. S. HUNTINGTON.

[Written for the AMERICAN RAILROAD JOURNAL.]

A GREAT deal has been said and written of late in regard to what may be termed "railway civil service reform," the object of which is to secure a more efficient corps of employés in every department of railway service. That the greatest care should be exercised in the selection of men for responsible positions is admitted by every one, but there are not a few who do not approve of the methods now being adopted by some of the leading roads for testing the efficiency of skilled operatives, or those who fill positions of great responsibility. The disapproval is not confined to candidates for employment as new applicants, or promotion of old employés, but prominent retired railway officials and successful managers of large business and manufacturing enterprises disapprove of the iron-clad examinations, or "sweating process," applicants for positions must suffer at headquarters. So long as the examinations are confined to questions on subjects connected with the duties the applicant is expected to perform, there is no ground for complaint, but when an aspirant for an ordinary operative's position has questions fired at him that would stagger a college professor, and are entirely foreign to the business in hand, it seems like a very silly proceeding and a waste of valuable time. The idea that a locomotive runner must be well up in the higher mathematics and able to tackle all the problems of Euclid, be well versed in all manner of 'isms and 'ologies, and be literally crammed with learning, is not popular with many of the oldest superintendents of motive-power, and they are satisfied with a runner who thoroughly understands his business and pays strict attention to it, and with them a finished education is of secondary importance.

I have before me a letter from a young man who some time since graduated from a telegraph college. When he left the institution he expected immediate employment in a telegraph office, but as he has only gained a "school knowledge" of the art, he is now going into a Western Union office to get a practical training, when his services will be likely to be in demand. Another man who graduated as an electric engineer, applied for employment at the office of a telegraph superintendent. When asked what he could do he replied that he had a thorough knowledge of electric engineering and could do anything in that line. The superintendent asked him if he could dig a hole, put a pole into it and shin to the top and wire it. He replied that that was not practiced where he was educated, and he was not wanted.

A graduate of an agricultural college applied to a thrifty farmer for employment. He understood agricultural chemistry; could analyze soils and fertilizers in great shape. The farmer wanted his ground plowed before he had any use for a chemist, and as the applicant had not learned to plow he had to look elsewhere for employment. These instances are not cited as proof that education is not desirable, but to show that the standard of excellence should not be measured by the number of languages a man can talk or the knotty problems he can solve, and that it is irrational and wasteful of time to drill men on questions of whose meaning they have no idea, and which they will never have occasion to use or understand. The only benefit that can be derived from the ability to answer all puzzling questions, an applicant may have put to him outside of matters pertaining to his calling is, that it shows the man to be intelligent, and can grasp ideas readily, but this can be as readily ascertained by confining the examination to pertinent questions that both the applicant and his employers would profit by. It is eminently proper for railway managers to improve the *status* of their operatives, but it has been clearly shown in the experience of many of the leading American railway managers that their best men are not those who are loaded down with a knowledge of a thousand-and-one things that are in no way connected with their duties, but who give their undivided attention to what is *necessary for them to know*, in order to be masters of the situation and enable them to perform their duties in a satisfactory manner. The color-blind craze of a few years ago resulted in the discovery that many of the oldest, safest and most trusty engineers were color blind, and in one instance the expert who examined them was a bad case of color blindness.

The authorities, legislative and otherwise, sought to serve the public by weeding out all men who could not match colored yarn, and they should no longer serve as engineers or pilots, and we were to have no more accidents on land or water from mistaken signals. But it soon occurred to railway managers that the weeding-out process was depriving them of the services of some of their safest men who had been with them for many years and never an accident, and in not a few instances new men who had certificates of perfect vision made fatal mistakes after serving less days than the veterans they displaced had been there years. It did not matter whether an engineer called a red light green, or *vice versa*, so long as he knew just exactly where it was and its meaning and acted accordingly, and it was an act of great injustice to discharge men who had safely taken trains through by night and day, past hundreds of colored lights and targets, for years.

If a finished education is regarded as necessary to make a first-class trainman, and legislative authority should demand the removal of all engineers and others who should fail to answer all the silly questions put to them by one of the modern, cranky examining boards, some

thousands of the best locomotive runners in America would have to "step down and out."

Education is desirable and a fine thing to have, but it is hardly advisable to ignore a good *practical training* and a good stock of common-sense when selecting men for responsible positions, and give precedence to men loaded with fine spun theories and nonsense.

Another matter which tends to reduce the efficiency of railway operatives is the excessive service required in the line of promotion. On some roads the term of service required for advancement is not only unreasonable but a direct insult to intelligent Americans who do not require a life-time to become expert in any line of service they may adopt as a profession.

In this country young men are supposed to be twenty-one years of age when they set out on the journey through life on their own account. Suppose a young man decides to win his bread by becoming a locomotive engineer and he wishes to reach the front rank of the profession. After serving three years in the machine shop, three years firing, three in the yard switching, and so on from one train to another through the regular order of promotion, he will be forty-two years old when he reaches the throttle he has been striving for for twenty-one years. Now, if this man had not mistaken his calling, and he was an average American, he has been held back on short pay for at least fifteen years and the company has been working a first-class man in a third, fourth or fifth-class position for the same period. If he was not a born engineer, the twenty-one years, or twice that, of drill and practice would not make him one. This is not American practice, although it has been introduced here to the manifest disadvantage of employers and employés. Promotion is so far off that there is but little inducement to seek it on the score of efficiency, as it is rather a matter of time than a "survival of the fittest." In selecting men for promotion their record of performances should be considered as well as their length of service. Of course, length of service should ordinarily take the preference, but there are numerous cases where men become expert with comparatively little drill or practice, and as it is for the interest of the railways as well as the public they serve to keep their most reliable men in the most responsible positions, they should be placed with reference to their "special fitness," regardless of what knowledge they may be loaded with on matters in no way connected with their duties, or the advantages they have had for superior training.

Some years ago, when European wars were making a great noise, our government selected a man who had been schooled in the art of war and sent him abroad to learn more. At the close of these wars he returned and was regarded as the greatest military man of the age. He certainly had the greatest advantages in that line of any man in America, and he was selected to crush our late rebellion. He proved a miserable failure, and was the very essence of incompetence; and the work that was expected of him was accomplished by men who had but a limited or no military training, and of whom the country had little to expect in the way of military genius. This is not brought forward as proof that there is no good in education or special training, but is mentioned as a single instance of thousands of a like nature where unfortunate selections have been made of men for responsible positions in all kinds of service, by placing too great reliance on what is usually termed thorough education. The finest railway officials in America are those who commenced at the bottom and reached the top after a practical experience in all departments of the service. Usually their advancement has been rapid, but their practical experience, together with a good stock of common-sense and habits of observation, has made them familiar with all working departments and they seldom make mistakes in their selection of skilled operatives. They select men for what they are worth; real merit being preferred to polish, tone and nonsense. In this matter let the fittest survive.

ARBITRATION INSTEAD OF STRIKES.

SENSIBLE WORDS BY THE LOCOMOTIVE ENGINEERS' JOURNAL.

THE *Locomotive Engineers' Journal*, of which Mr. P. M. Arthur, chief of the engineers' brotherhood, is one of the editors, has an extended and able editorial in its May number headed "Arbitration the true method to settle labor controversies," from which we take the following—taking issue only with the assumption that strikes are *ever* necessary:

"There are two recognized methods for the settlement of labor controversies, arbitrating and striking. We have no hesitancy in declaring that arbitration is the better method, the most rational and, all things considered, productive of incalculably the best results. In saying this, we must not be understood as condemning strikes as a last resort—when all other means for obtaining rights and for maintaining rights have been exhausted.

"In adducing such arguments and illustrations as we can command, to demonstrate that arbitration is a better method than the strike to settle labor controversies, and the true method to settle such controversies, we shall first present the financial, the dollar-and-cent aspect of the case, because labor controversies generally originate in the question of wages and earnings.

"It matters little what numbers are employed for the purpose of illustration. For convenience we will suppose 1,000 men receiving $1 a day become dissatisfied and demand $1.25 a day. We will suppose the demand is refused, and that a strike is ordered. We will suppose the strike thus inaugurated continues six months, or 150 working days, and that at the expiration of that time the demand is granted and work resumed.

"We are now in a position to make out a balance sheet showing of profit and loss.

"One thousand men working 150 days at $1.00 a day receive $150,000, and, since they did not work, being engaged in a strike, they lost $150,000, the amount they would have otherwise received.

"We will say, and the estimate is certainly low enough, that these 1,000 workingmen and their families required $1.00 a day to supply them with the necessities of life, since it does not matter whether at work or idle, the expenses of living are maintained. As a consequence, since the strikers did not earn a dollar a day while idle, but did expend a dollar a day during the strike, $150,000 was required. Here, then, we have the fact, that the strikers at

the expiration of the strike, 150 working days, are out of pocket $300,000. They lost what they did not earn, $150,000, and they expended from previous earnings $150,000 to live; or, if that amount had not been accumulated, it was obtained by borrowing or otherwise going in debt.

"We have stated that the strike was ordered because the employer would not pay the advance demanded, twenty-five cents a day. But at the expiration of six months, 150 working days, we will assume for the sake of illustration, that the demand of the men was granted, and that the work was resumed at $1.25 a day.

"We have shown that the men, on the day work was resumed, were out of pocket $300,000. The question now is, how long will it require them to make good this loss, at the advance of twenty-five cents a day. One thousand men at twenty-five cents a day receive $250.00 a day, and it will, therefore, require 1,200 days, just four years of 300 working days each, to recover the money sunk in the strike.

"But suppose instead of striking, arbitration had been chosen as a means of settling the controversy. In that case there would have been conferences between employer and employed, during which time work would have proceeded as usual. The employer would have frankly stated his reasons for not acquiescing when the demand was made for an advance, and the employés, in turn, would have urged their necessities; and finally, we will suppose an agreement was reached, and an advance of 15 cents a day conceded. How stands the account at the expiration of six months, or 150 working days, and at the expiration of four years from the time work was resumed.

"One thousand men working at $1.15 a day receive $172,500 for 150 days' work, and having saved what the strikers expended, find themselves better off than if they had struck, by the amount received, $172,500 and by what they had saved of previous earnings, that would have been expended during the strike, $150,000, a total of earnings and savings, of $322,500.

"We have supposed in case of the strike that after six months, or 150 working days, the workingmen received $1.25 a day, and we have shown that it would require just four years, at the advance of twenty-five cents a day, to make good their losses during the strike.

"Suppose the strike occurred on the 1st day of January, 1882, and continued till the 1st day of July, 1882, in that case work would have been resumed on the 1st day of July, 1882, and the four years required to make good the losses sustained would have extended from July 1st, 1882, to July 1st, 1886. During that period the 1,000 men at $1.25 a day would have earned $1,500,000.

"If arbitration had been the method of settlement adopted the account would have stood as follows: 1,000 men, working at $1.15 a day from January 1st, 1882, to July 1st, 1886, four and a half years, 300 working days to the year, would have received $1,552,500, or $52,500 in excess of the amount received by the men who settled their controversy by a strike.

"From a money point of view, arbitration is manifestly a better method than the strike for the adjustment of controversies between labor and capital, or employer and employé. But arbitration presupposes that employers will always be ready to listen to the grievances of employés, and will respond in the spirit of justice and fair play. And it also presupposes that employés have real grievances which ought to be investigated. If employers pursue a different policy, if there is hesitancy and postponement, or the exhibition of arrogance and superiority which ought not to be manifested, and which is fruitful of ill-omened opposition—strikes, however objectionable they may be, or however disastrous in their consequences, may be expected to disfigure the pages of our industrial history in the future as in the past, and even now.

"Arbitration must be based upon mutual confidence, upon the idea that both parties are earnestly seeking for a basis of settlement mutually beneficial. This done, results can be predicted with unerring certainty.

"We have written of arbitration as a better method than the strike for the settlement of labor controversies in its financial aspects only, but we do not pretend to have exhausted the subject; indeed, we have discussed only the profit and loss to the workingmen. Justice demands that the profit and loss of employers should be stated. To give this branch of the subject the prominence to which it is entitled, would extend this article beyond prudent limits. It may be, in this connection, sufficient to say, that capital and labor being interdependent, when one suffers, both are injured, and that when both are employed, prosperity becomes a universal benediction. Nor are employer and employé alone interested in sustaining amicable relations between capital and labor. There is a great public ever watchful and profoundly concerned in such questions, and this fact demonstrates the absolute correctness of the proposition with which we started out that the alliance between capital and labor is natural, necessary and inevitable.

"But there is another vastly important view to be taken of the subject. a view ouside of the domain of wages and dividends. We refer to the moral feature of the subject.

"In writing of arbitration we believe it to be potent in the development of the better qualities of human nature and of bringing them into active service, such as integrity, veracity, justice and those honorable ambitions promotive of individual and public welfare; while strikes, in the very nature of things, beginning in antagonisms, are liable to engender deep-seated animosities which all too often develop into overt acts of hostility, and which, dethroning judgment, enthrone anger, and giving passion full sway occasion deplorable excesses.

"We do not say there are not exceptions, but with current records in full view, we are warranted in saying that the tendency of strikes is in the direction of conditions at war with the welfare of those who engage in them and that they are prejudicial to the welfare of society.

"The legitimate deduction from such premises is, therefore, that arbitration is the true method to settle labor controversies; the true method financially, and the true method morally, because it brings into operation the better qualities of human nature.

"Arbitration appeals directly to men's judgment, to what may be termed rectitude in human affairs, without which the idea of settlement of controversies upon a righteous and permanent basis, must forever be visionary and vain."

HYDRAULIC LIFTS ON THE MERSEY RAILWAY.

BY WILLIAM EDMUND RICH.

[A Paper read before the Institute of Civil Engineers, May 4th.]

A NOVEL feature of the Mersey Railway was the introduction of large hydraulic lifts for conveying passengers and their luggage from the deep underground stations at James street and Hamilton street to the daylight stations at the street level above. At each station there were three lifts, which were worked quite independently of one another, and were each capable of raising 100 passengers at a time. The average journey was accomplished in from 30 to 40 seconds, and the three lifts working simultaneously were capable of raising a heavy train load of 300 passengers to the surface in about a minute.

The lifts at James street had a stroke of 76.6 feet, and those at Hamilton street a stroke of 87.7 feet, and there was 50 per cent. more engine-power at the former station; but in other respects a description of the arrangements at James street would suffice.

Each lift was of the direct acting ram type, and was contained in a rectangular shaft 21 feet long, 19 feet wide, partly excavated out of the solid red sandstone rock, which stood well without lining, and partly inclosed in walls of brick in cement. This shaft descended to 8 feet below the lower hall floor, and a central boring 40 inches in internal diameter was carried down 75 feet further.

The cylinders which inclosed the ram were suspended in this boring from a large bell flange on the top length. They were 21 inches in internal diameter and were fitted with a hat-shaped leather at the top end for making the joint round the ram.

The ram was 18 inches in diameter and ½ an inch thick, and was constructed of mild steel lap-welded tubes in lengths of about 11 feet 6 inches, connected together with internal screwed ferrules 6 inches long and 15¾ inches in internal diameter. For extra security wrought iron rods 1½ inches in diameter were carried up the center of the ram, which at its top end entered the boss of a large forged steel cross, and was secured to it by the above rods and turned bolts. The cross was 11 feet long and 9 feet 6 inches wide, and was forged by Messrs. Clay, Inman & Co., from a single steel ingot. The ends of the arms were riveted to girders, which were laid transversely beneath the lift cage, and extended beyond its sides to enable the the counterweight chains to be attached at their outer ends. The ascending room or cage, was a handsomely paneled wooden structure 19 feet 6 inches long, and 16 feet 6 inches wide, and 8 feet to 10 feet high, measured on the inside, with seats for 24 passengers at the sides, and a large gas-lamp in the center of the roof. It was founded on pitch pine floor joists 10½ inches deep, which were strapped down to the iron girders above mentioned with iron stirrups. It was guided by four cast iron V-guide brackets bolted to the ends of the cage girders, and bearing against four steel guide-rails of a special section, which were fixed to the side walls of the lift space. Four similar rails guided the counterweights, which were suspended by 1⅛ inch chains; these passed over pulleys at the top of the lift space, and at their other ends were attached to the extremities of the cage girders. Two chains 7 inches apart were attached to each weight, and thus relieved the ram of transverse strain, if the load was concentrated near the front or the back of the cage. The lift starting valve was a gun-metal slide, working over V-shaped ports, and was actuated by hemp hand-ropes with wire cores, which passed through the cage on either side of the doorway, with stops on one rope for automatically closing the valve when the cage reached the top or the bottom floor. The lifts were worked by water at a low pressure from a 10,000 gallon circular wrought-iron tank, contained in a tower with its bottom at about 111 feet above the street level. The water was discharged during the down stroke into a waste tank of similar capacity with its bottom at 10 feet above the lower hall floor. The net effective fall was thus 176.5 feet, or 76.4 pounds per square inch. The engine-room floor was 27 feet above the lower hall, and contained three steel marine boilers and three pairs of high-pressure duplex pumping-engines, each capable of raising 500 gallons per minute.

Track Laid from January 1 to May 1.

FOUR months of the year 1886 have now gone and the season of railway construction is fairly open. Previous to May 1 comparatively little construction takes place, the long winters in the north and the early floods in the warmer latitudes presenting natural obstacles to the work of grading, bridging and track-laying, and the early part of the year also being chiefly required for maturing financial plans and collecting the material and forces for the forward work of the later seasons. In 1885 railway construction reached the lowest figure shown in this country for seven consecutive years, the total addition to our mileage being in round numbers only 3,200 miles. The present year opened somewhat under the depressing influences of the previous year, and although it has already been signalized by the projecting of numerous plans for railway extension, covering many thousands of miles, there has not yet been time for the active campaign to fairly begin and of course not much track-laying could be expected up to the present. Nevertheless we find from returns received at this office that a very considerable extent of mileage has already been laid down, as the following tabie will show:

TRACK LAID DURING THE FIRST FOUR MONTHS OF 1886.

State.	No. Lines.	Miles.
Alabama	1	2.0
California	4	43.2
Florida	3	83.5
Georgia	3	15.0
Indian Territory	1	10.5
Illinois	2	88.0
Indiana	1	30.0
Kansas	4	54.5
Kentucky	1	24.0
Louisiana	1	9.0
Michigan	1	1.0
Minnesota	1	3.0
Mississippi	1	4.0
Missouri	1	14.0
North Carolina	1	2.0
Ohio	1	5.0
Pennsylvania	2	16.0
South Carolina	1	8.0
Texas	4	122.1
Washington Territory	3	37.7
West Virginia	1	4.0
Wisconsin	2	90.0
Total in 22 States	40	666.5

It thus appears that we have a record of track-laying in the present year in 22 of the States and Territories on 40

lines, which has already reached an aggregate of 666½ miles of main track, not counting the very considerable mileage of sidings and of old track relaid. This total is about twice that reported up to the same period last year, although the winter of 1884-5 was much more severe than the one just passed, which would account in part for the small amount of construction last spring up to the same date; but the total given for the past four months is also larger than that for the same period in 1884, and indeed in any of the last thirteen years, excepting the four years, 1880, '81, '82 and '83, the aggregate of construction for 1882 exceeding that of any previous year in the history of the country. It will be seen from the table that some track-laying has already been done in nearly half the States of the Union, although most of them report only one road each. The principal activity thus far appears to be in Texas, Wisconsin, Illinois, Florida and Kansas, and these figures are an indication of the very large mileage which is actually under construction in these States, as the record for the full year will show. Of the 40 lines referred to in the table, track-laying is still in progress on at least 24, and these alone expect to add fully 1,800 miles to their present mileage during this year.

The important characteristic of the construction work for the present year is the fact that it will be largely done by a few great competing companies, who have set out to parallel or head off each others' extensions in the most rapidly growing and central portion of the Union. While also a large number of independent projects are on foot, many of which will take tangible shape if the labor troubles do not stop the wheels of enterprise, still the greater part of the new mileage for 1886 will be due to the progressive movements of the already great companies. Although it is too early to indulge in any definite predictions, there have already been laid out, and to a considerable extent entered upon, a sufficient number of new lines to make it reasonably certain that the aggregate of track laid in 1886 will be very considerably greater than in 1885, and probably greater than that in 1884 also. As the year 1882, when the enormous amount of 11,568 miles of track were laid in the United States, marked the culmination of a period of extraordinary activity in railway building, so the year 1885 doubtless marked the end of a three years' period of rapid decline in construction, and we now seem to have entered again upon the up grade, in this respect.

Certainly the prospect for manufacturers of railway material and supplies, and for contractors and workmen in railway construction is very encouraging, provided always that irresponsible and idiotic labor agitators do not forcibly interfere to prevent the natural tendency toward activity and general prosperity.—*Railway Age.*

Railway Earnings in April.

A LATE issue of the *Railway World* says: "A table of the reports of sixty-eight companies shows that their gross earnings in April represent a net increase of $252,902. This result is unexpectedly favorable, in view of the depressing influences that prevailed during the month, and the serious losses suffered by a number of the lines. The aggregate receipts were $17,885,481 in April, 1886, against $17,632,579 in April, 1885. Losses are reported by twenty-three lines, or subdivisions of lines, and the list does not embrace the roads most seriously affected by the northwestern strike, such as the Missouri Pacific and Texas and Pacific. The most serious diminutions of earnings are those reported by important northwestern and southern lines. On leading northwestern lines the following declines occurred: Chicago, Milwaukee and St. Paul, $163,264; Chicago and Northwestern, $29,229; St. Paul, Minneapolis and Manitoba, $100,708. The losses reported by lines traversing Southern States include the following: Southern Division of the Illinois Central, $61,771; Louisville and Nashville, $192,009. The losses on the northwestern roads were probably caused chiefly by a diminution in the magnitude of the grain movement, and the losses on the southern roads named are partly due to differences arising from the beneficial effect of the New Orleans Exposition on the earnings of last year, partly to increased competition, and partly to other causes. Some of the incidental effects of the strike are presumably indicated in a decrease of $20,602 in the earnings of the St. Louis and San Francisco, and a decrease of $31,323 in the earnings of the main line and branches of the St. Louis, Alton and Terre Haute.

"The list of gains includes $110,257 by the Northern Pacific, which is partly due to an increase of 288 miles in the length of the lines operated, and partly to the fact that influences affecting much of its traffic were different from those which reduced the earnings of the northwestern roads that suffered losses. Southern lines near the Atlantic seaboard were more fortunate than those located near the Mississippi. The Richmond and Danville reports an increase of $39,703 on its main line, and small gains on each of its subdivisions.

"The most noticeable and significant gains were those reported by roads whose revenues have been presumably increased by the persistent efforts of the trunk lines and their western connections to check and prevent ruinous competition. It is chiefly on this account that the Grand Trunk, of Canada, reports an increase of $73,517, and the Wabash a gain of $160,462, and that nearly every direct western connection of trunk lines increased its earnings during April, notwithstanding the depressing effect of the strikes."

Duty of Companies to Passengers at Stations.

IN the case of Thompson against the Central Railroad and Banking Company, the Georgia Supreme Court holds as follows:

1. It is the duty of a railroad company so to fix its station or depot that a passenger who gets off at a depot or place to alight may get off the car without danger; and it is also its duty to fix such a way of exit from the depot over its right-of-way that the passenger may go away from the place at which the passenger is invited to get on and off without danger to life or limb; but it is not its duty to see him safe and secure in his exit from the track and over its right-of-way. The carrier is not bound to insure him a safe exit from the depot, but to insure only a safe way for him to use for an exit.

2. The charge on this subject was hardly apposite to the case, where the injury did not occur at a depot, but a point several hundred yards from the depot, where he

was induced by the agents of the company to leave the train, or else voluntarily left it, without inducement from them. There is a difference between the ordinary announcement of a station as the train approaches it, so that the passengers may prepare to leave the train when it reaches the station, and the announcement after the train has stopped; in the latter case it is equivalent to inviting the passengers for that station to leave the train. If the passenger in this case got out without such an announcement, it was his act; if he was deceived by the announcement, it was the company's act, so far as fault is concerned.

3. The railroad company contracted to give the passenger in this case a safe transportation to the station of his destination, and until it carried him to that regular and safe landing, it was responsible for slight neglect, extraordinary diligence being the measure of its care for him to that place. But though the company may have been negligent, it could defend itself and defeat a recovery of damages by showing that when the passenger was endangered by its negligence, he could have avoided the consequences of it by the use of ordinary care.

4. In defense to a suit by a widow against a railway company for the homicide of her husband, a recovery may be defeated if the husband's own negligence either caused the injury, or if he could have avoided the consequences of the defendant's negligence by the use of ordinary care.

American Competition in Australia.

THE somewhat important announcement is made that a contract has been signed between the Government of New South Wales and the Union Bridge Company of New York, for the construction by the latter of a bridge 3,000 feet in length across the Hawkesbury, one of the most important rivers of the colony. The structure which is about to be commenced is a double-track railway bridge, consisting of seven spans of 415 feet each, resting upon stone piers. The foundations, which are to be of beton, inclosed in iron caissons, are to be carried 170 feet below tidewater, and the work is to be completed in two years and a half for £300,000—a sum very much below the original estimates framed by the colonial government engineer. The contract was obtained in competition with English contractors, and is stated to have been awarded to the Union Bridge Company of New York on the decision of certain colonial engineers that the foundations proposed were the best among sixteen plans submitted for consideration. This piece of intelligence will naturally be read with considerable interest by English industrials, as it shows beyond all doubt, first, that American firms have their attention keenly directed to works on hand in the Australasian colonies; and, second, that the proprietors of English works will have to make up their minds to execute contracts based upon the lowest possible rates. We are not, however, disposed to at all despair of the retention of, at any rate, a large share of the Australasian markets by English industrials, provided they can show more adaptability to the conditions of colonial life. American firms have probably one advantage over English competitors, namely, that the United States call for comparatively new and impromptu devices to deal with natural obstacles. The effect of this is to stimulate the inventive power of the Americans, and, to put the matter in homely language, they are probably somewhat readier witted than Englishmen, who are more prone to move in some old-established groove. This is true not only of bridge building but also of the building of locomotives. The Americans long since devised locomotives which were more adapted not only to the roughly constructed railways of their own country, but also to new lines at the Antipodes. By the introduction of the bogic truck American locomotive builders have succeeded in turning out engines capable of rounding curves and running on road-beds which would have altogether frightened English firms. So with bridge building; American engineers have made it quite a specialty; the formidable rivers with which they have to deal in their country have taxed their inventive powers to the utmost, and they are accordingly very much at home when they are called upon to devise bridges for railways at the Antipodes.—*London Colliery Guardian.*

Increase in Trade Journalism.

ACCORDING to a late issue of the *Clothier and Furnisher*, of the 722 newspapers and periodicals published at New York City, a little over one-sixth, or 122, strictly come under the head of news and general information. The journals of a special character, but also furnishing general news, and the papers and periodicals dealing with special matters of universal interest, augment the 122 newspapers mentioned to 413. The remaining 309 are purely class papers and trade journals.

In 1860, as regards to number, the five leading classes of newspapers and periodicals in New York and the five minor classes were as follows:

General news	81
Religious	57
Literary	25
Commercial	11
Medical	8
Science	7
Trade	5
Railroads	3
Education	2
Mechanics	1

The classification at the present time is as under:

Trade	127
General news	122
Religious	89
Literary	56
Medical	37
Commercial	27
Science	25
Mechanics	20
Education	15
Railroads	14

The above comparison is particularly valuable as showing the enormous increase of trade journals in the quarter of a century. They now outnumber all other classes.

The Proposed English Railway Legislation.

ACCORDING to a recent issue of the *Railway World* the character of some of the changes contemplated by the bill recently introduced in the House of Commons, with the sanction of the existing government, has excited much alarm among English railway managers. They claim that it seriously endangers the security of railway property, and violates or repeals provisions which led shareholders to invest their money in railway enterprises. Several important companies have addressed circulars to their stock-

holders, inviting them to attend meetings which are to be held for the purpose of considering the best methods for defeating the new bill. In one of these circulars it is denounced as "absolutely confiscatory in its character," and its tendency and probable effect is declared to be to "deprive all owners of railway stocks of every security for their capital and income." In another circular special attention is directed to the following provisions of the bill, which are declared to be objectionable in principle, viz.: "1. The revision of maximum rates and charges compulsorily, instead of by agreement. 2. The giving of powers to the Board of Trade to intervene between traders and railway companies, when the rates are neither illegal nor unfair. 3. The prohibition of any appeal upon the question of undue preference. 4. The unlimited power to the Board of Trade to require statistical returns from railway companies."

The new measure is regarded as one of the most radical that has ever been seriously proposed in England, and it approximates, in some of its requirements, to the granger laws of this country. A meeting of the shareholders of the Metropolitan declared that it "practically transfers the management of railways from responsible managers to a government department which is not responsible to the public for accident or errors in management or administration."

The result of the approaching struggle will be awaited with interest. The English lines may be more deeply affected by adverse legislation than the American railways which have heretofore been obliged to cope with unjust legal requirements, inasmuch as many of the British rates are fully up to the standards authorized by charters, while here the opposite rule prevails very extensively.

The London *Railway Times*, in commenting upon the bill, says that "the custom seems to have gained ground of late of regarding the railways, not as commercial concerns, as they really are, struggling for a return upon the capital invested, but as national institutions existing merely for the benefit of the public; and it is this which renders it almost impossible to arbitrate between two interests so diametrically opposed." The fact that railways are commercial concerns, "struggling for a return upon the capital invested," is so generally ignored by the agitators of anti-railway measures in this country, that it is refreshing to notice a repetition of this fundamental truth. Horatio Seymour indirectly reiterated it, in a discussion of transportation questions published a short time before his death, when he said, in substance, that the efforts of railway managers to secure a reasonable return for the capital invested in railway property were commendable. But this vital consideration is usually treated with contemptuous indifference by the average advocate of important changes in existing railway legislation.

Car-Couplers in Michigan.

THE Michigan Railroad Commissioners have selected seven automatic or safety car-couplers for use in that State. As the law now stands, therefore, no railroad in that State can fix any other coupler to their freight-cars. It is therefore a matter of some surprise that the list of couplers selected excludes several that are in extensive use in various parts of the country, and some that have been approved of in another State. The couplers selected by three different bodies, the Master Car-Builders' Association, and the Railroad Commissioners of Massachusetts and Michigan respectively, include collectively no less than 17 different devices. If New York and other States follow the example thus set by Massachusetts and Michigan, the number of couplers approved of in one State and not considered worthy of use in another will be largely increased. The following table shows the present state of the question:

APPROVED AUTOMATIC CAR-COUPLERS.

Master Car-Builders' Association, Sept., 1885.	Massachusetts Railroad Commissioners, Jan., 1885.	Michigan Railroad Commissioners, May, 1886.
.....	.....	Aikman.
Ames.	Ames.	Ames.
Archer.	.....	.....
.....	.....	Blocker.
Cowell.	Cowell.	Cowell.
Dowling.	.....	.....
Gifford.	.....	.....
Hein.	.....	.....
.....	Hilliard.	.....
Janney.	Janney.	.....
Marks.	.....	Marks.
.....	.....	McCree.
McKeen.	.....	.....
Perry.	.....	Perry.
Thurmond.	.....	.....
Titus & Bossinger.	.....	.....
.....	United States.	.....

It thus appears that no fewer than 17 different couplers have been approved of by three independent bodies of men, acting in a quasi-judicial capacity and not as the officers or advisers of a money-earning corporation. An eighteenth coupler, the Smillie, has received a practical indorsement from a railroad in the shape of a large order from the Delaware, Lackawanna and Western. We may, therefore, say that some twenty different car-couplers have already received the more or less emphatic approval of bodies of men who have had some opportunities of testing the merits of the rival inventions. This gradual widening of the list certainly does not seem to promise an early solution of the car-coupler question in the direction of the general adoption of practically interchangeable couplers.

It will be observed that the Michigan list includes three couplers, Aikman, Blocker and McCree, which were not mentioned by the Master Car-Builders' Association or the Massachusetts Railroad Commissioners. These couplers may possibly possess sufficient merit to render them worthy of a more extended practical trial, but it is difficult to see on what grounds the Michigan commissioners have shut out several undoubtedly good couplers which were approved of by the most competent practical judges, the Master Car-Builders' Association. The master car-builders had not only the results of the trials at Buffalo to guide their decision, but also had access to the confidential information acquired by the use of the majority of the couplers in practical service on their own lines. Possibly, however, the Michigan commissioners are willing to try further experiments and include in their lists some of the couplers which the Master Car-Builders' Association and several large railroads consider possess great practical merit.

The course things are taking, however, shows how unfit any State tribunal, even if technically qualified, is to give decisions on such a matter, simply because it is a question of national and not of State interest. There is nothing

to prevent the New York Commission from excluding from the couplers to be used in their State *all* the couplers approved for application in Massachusetts and Michigan, and then cars built for New York companies would be excluded from both those States.—*Railroad Gazette.*

Record of New Railroad Construction.

INFORMATION of the laying of track on new railroad lines is given as follows:

Pennsylvania.—A branch is completed from near Altoona, Pa., to the Tipton Run coal mines, 4½ miles.

St. Johns and Halifax.—Track laid from Ballstown, Fla., southeast to the Tomoka river, 40 miles.

Southern Pacific.—The Northern Division is extended from Soledad, Cal., south 2½ miles.

This is a total of 47 miles on 3 lines, making in all 853 miles thus far reported for the current year. The new track reported to the corresponding date for 15 years has been:

	Miles.
1886	853
1885	546
1884	913
1883	1,593
1882	3,203
1881	1,480
1880	1,519
1879	619
1878	407
1877	461
1876	542
1875	260
1874	436
1873	918
1872	1,557

These figures include *main track only*, second or other additional tracks and sidings not being counted.

Watching a Railway Collision.

AN eye witness of the Monte Carlo accident sends to the Paris *Temps* the following description of it:

"The catastrophe which has just taken place on the Monaco frontier has a peculiarly dramatic character. It occurred under the eyes of five or six hundred persons, helpless to prevent it, and this is one of the most thrilling features of the event.

"At five o'clock precisely the train, No. 483, was at Monte Carlo station, being five minutes late. Hundreds of passengers alighted. A still larger number of people were preparing to start for Nice by the train expected from Mentone. There was unusual bustle on the platform. At this moment I saw the station-master, of whom several persons were asking information. He seemed flurried. 'Enter my office,' he said to two of them; 'I will attend to you presently.' He then, as it seemed to me, ran to see after the luggage. Suddenly the train moved on. I can still see the guard jumping down from the luggage wagon. The station-master had at this moment an instinct of the disaster about to happen. 'Who signaled train 483?' he asked, in a voice broken by emotion. 'Not I,' replied the head porter. 'Was it you, then?' said he to a second official. 'No, sir.' At this answer the unfortunate man put his hands to his head and became quite livid.

"It did not take more than a second for the crowd to comprehend the danger which the train was incurring. Moreover, the coast between Cape St. Martin and Monte Carlo is so curved that the whole line was under the spectators' eyes. Three trains could be seen, with their puffs of white smoke. The first was about to enter the St. Martin tunnel, and ran no danger; the second had just left Roquebrune, and was advancing at full speed against the one going away from us. No idea can be formed of the anguish of the three hundred or four hundred spectators of this scene. At first everybody hoped that the collision would not take place. The coast was all open. 'They will see each other in time,' said people on all sides. The station-master ordered all the bells to be rung, in order to make as much noise as possible. Four hundred men rent the air with their cries. The two columns of smoke, however, continued to get closer and closer. Those in the two trains did not see each other. Everybody screamed and gesticulated. Such impotence, in presence of such a danger, was enough to drive one mad. At last the driver of the train coming from Mentone saw the danger, and reversed his engine. But the other, in consequence of the curve, noticed nothing, and continued to advance. They were within 200 metres of each other—100 metres—10 metres. A great shudder ran through the crowd. The women turned away their heads, not to see what happened. A sharp cry was heard as a girl went into hysterics.

"The collision took place. The two trains were seen tilted up one against the other, and then there was a horrible incident; two or three carriages, falling over the parapet, were precipitated on to the rocks on the coast. A thick smoke spread all around. Driven to despair, the station-master no longer knew what he was doing. There were cries on all sides of 'the doctors! the doctors!' Every one rushed forward. Twenty-five or thirty persons went up the line, and reached the spot where the accident had happened. It is impossible to describe the scene. No one can form an idea of it but those who saw it.

"The two carriages which had fallen from a height of thirty metres on to the rocks and shingle seemed to have been reduced to dust. Luckily there were only three persons in them. One was killed on the spot. By a miracle, the two others were only injured. They are seriously injured, no doubt, but their recovery is not despaired of. The two engines had become, so to speak, welded into each other. Behind and above them four carriages of the Mentone train were piled on each other, twisted out of shape. A young man at great risk to himself succeeded in turning off the valves, which were throwing out a blinding steam, and then the injured persons were found. I saw seventeen, more or less seriously hurt, taken away.

"Close to where I stood I saw an arm, on which the person next to me was on the point of treading. An attempt was made to extricate the unfortunate man to whom it belonged. But the bars of iron, beams, broken wood, doors, roofs, bolts, and broken glass were so bound together as to render the task almost impossible.

"To understand the violence of the shock, it is necessary to imagine two engines and four carriages occupying, as regards length and length, the place of one ordinary engine. A second-class carriage had been turned completely upside down, and had lost its wheels.

"The authorities from Nice and Mentone arrived at the scene of the accident during the night, and the work of clearing away the rubbish was begun by torch-light."

English Rail Importations.

ACCORDING to the *Railroad Gazette* the recent purchases of English rails by the Michigan Central and the Chicago, Burlington and Quincy railroads are probably the cause why the Board of Trade report shows the British export of rails to the United States to have been larger last April than in any other April since 1882, and larger than in the whole year 1885. They cannot be called large, however, having been 6,836 tons, which is not more than two days' consumption. Nevertheless, they were more than the British exports in that month to any other country except India, and more than one-fifth of the total exports, the exports to other countries being exceptionally small, and one-third less than last year. For the four months ending with April, the British exports have been:

Year.	To U. S.	To other countries.	To all countries.
1879	1,184	90,982	92,166
1880	62,301	109,451	171,842
1881	86,292	92,079	178,371
1882	88,921	159,788	248,709
1883	19,222	238,401	257,623
1884	8,647	166,857	175,504
1885	3,001	146,495	149,496
1886	8,672	106,908	115,580

Thus the total British rail exports for the four months ending with April have been smaller this year than in any other since 1879. The activity in railroad construction, which began here in the last half of 1879, did not appear in the countries which England supplies with rails until 1882; but while we reached our maximum construction in 1882, those countries did not reach their maximum until 1883, and for three more years took more rails than in any year before 1882. These countries other than the United States, several of which are supplied exclusively from England, including the British colonies, which, next to this country, are the greatest railroad builders, have this year taken 27 per cent. less rails than last year, 36 per cent. less than in 1884, and 55 per cent. less than in 1883. We must conclude, therefore, that this is a period of exceptionally little railroad construction outside of Europe and the United States, which supply themselves chiefly with rails, not depending upon English mills.

An Early Electric Motor.

PROFESSOR PAGE made a trial trip with his electromagnetic locomotive on Tuesday, April 29, 1851, starting from Washington. The progress of the locomotive was at first so slow that a boy was enabled to keep pace with it for several hundred feet. But the speed was soon increased, and Bladensburg, a distance of, I believe, about five miles and a quarter, was reached in thirty-nine minutes. When within two miles of that place, the power of the battery being fully up, the locomotive began to run, on nearly a level plane, at the rate of nineteen miles an hour, or seven miles faster than the greatest speed heretofore attained. This velocity was continued for a mile, when one of the cells cracked entirely open, which caused the acids to intermix, and as a consequence, the propelling power was partially weakened. Two of the other cells subsequently met with a similar disaster. The professor proceeded cautiously, fearing obstructions on the way, such as the coming of cars in the opposite direction, and cattle on the road. Seven halts were made, occupying in all forty minutes. But, notwithstanding these hindrances and delays, the trip to and from Bladensburg was accomplished in one minute less than two hours. The cells were made of light earthenware, for the purpose of experiment merely, without reference to durability. This part of the apparatus could therefore easily be guarded against mishap. The great point established was, that a locomotive on the principle of Professor Page, could be made to travel nineteen miles an hour. But it was found on subsequent trials that the least jolt, such as that caused by the end of a rail a little above the level, threw the batteries out of working order, and the result was a halt. This defect could not be overcome, and Professor Page reluctantly abandoned his discovery.—BEN. PERLEY POORE.

One Month's Accidents.

THE railway accidents for March show 22 collisions, 55 derailments and four other accidents, or 81 in all, in which 49 persons were killed and 131 injured. Two collisions, 15 derailments and one other accident caused the death of one or more persons each; 8 collisions and 13 derailments caused injury to persons, but not death. In all, 18 accidents caused death and 21 injuries, leaving 42, or 52 per cent. of the whole number, in which there was no injury serious enough for record. The yearly average for the four years was 1,340 accidents, 392 killed and 1,700 hurt. The monthly average for last year was 87 accidents, 28 killed and 115 injured. The average per day for the month were 2.61 accidents, 1.58 killed and 4 23 hurt; for the year there were, 2.86 accidents, 0.91 killed and 3.79 injured. The average casualties per accident were, for the month 0.605 killed and 1.617 injured; for the year, 0.318 killed and 1.326 injured. March was thus below the average of the year in accidents, but above it in the number killed and injured.—*Railway Reporter.*

By Rail to Constantinople.

THE lack of direct railway communication with Constantinople is every day felt as an increasing grievance, not only in the North Balkan States, but in central and western Europe generally. Amongst other regretable consequences of the late revolution in Eastern Roumelia and the Servo-Bulgarian war is the fact that, through those events, the Bulgarian authorities have been prevented from proceeding to the construction of the short line in Bulgarian territory which is all that is now wanting to complete the entire through-railway system connecting the Turkish capital with all parts of Europe. At length, taking advantage of the present respite from the pressure of external difficulties, Prince Alexander's government is devoting its earnest attention to this most urgent question with a view to discharge the engagements it entered into at the *Conference à Quatre.* Unfortunately, the Bulgarian company which had undertaken to build the Bulgarian section of this important international line has been compelled to go into liquidation. The contractor is seeking to form a fresh company to carry out the work, but it appears doubtful whether Bulgaria will not ultimately be compelled to have recourse to foreign capital to enable her to fulfill her engagements in this matter. —*London Standard.*

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NEW YORK, JUNE, 1886.

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(*Written for the American Railroad Journal.*)

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MISCELLANEOUS AND SELECTED.

STREET-RAILWAYS.

NEW INVENTIONS.

A SINGULAR SHOWING.

THERE would appear to exist a most amazing degree of confidence and trusting innocence in the rank and file of the various labor organizations, now and lately rampant, if we may judge by some specimen published reports.

In all other forms of business where large sums of money are handled, especially by paid agents, a rigid scrutiny is applied to the methods of the managers and financial disbursers, and every man, in however slight degree responsible, is held to strict account for every dollar passing through his hands. This does not necessarily imply a doubt as to the honesty of the various handlers of the cash, but is an eminently proper and necessary accompaniment to good and successful management of general and particular funds, no matter what their purpose or intent. No insurance company, bank or railway would for a moment dream of leaving their funds at the mercy of a set of men, even though their reputations for strict integrity and uprightness were considered beyond the faintest breath of suspicion: for let them be ever so honest and above doubt, a system which calls for no strict accounting and the presentation of full vouchers, can bring about but one result. Misappropriation more or less ruinous will as surely follow as the rising and the setting of the sun.

So well known and generally acknowledged is this truth that to learn and consider the methods—or rather lack thereof—in the financial department of railway and other labor organizations affords an insight into their workings and so-called management that leaves no longer room for surprise that so vast and apparently wealthy organizations as the Knights of Labor and the Unions should have accomplished so little.

Shortly after the inception of the Missouri Pacific strikes all readers of the newspapers were amazed to see the large sums of money raised for the strikers' relief, with apparently the utmost ease, and as frequently as called for or needed. In view of this impressive fact it was generally considered that the strikers were in a position where their own necessities at least could not come into play as a factor in the contest, as it seemed evident that, so well supplied with means, they were capable of holding out for practically any length of time, and poverty could not force them to submission or a compromise. In spite of this appearance of strength it was not long before there was a very evident desire to back down, frankly owning lack of means to live to be the cause; and now the strike is dead, and for some months the army of former workmen, with some very few lucky exceptions, have been and still are in dire straits through poverty.

The comic weekly, *Puck*, of June 16th, published certain

figures taken from the fiscal report of Typographical Union No. 6, a portion of which we use as an explanation of this singular state of affairs. This account is in two principal divisions, viz.: "Strike Relief Account" and "Committee Service and Strike Account." The total of the former for the years 1883 and 1884 amounted to the sum of $9,121.68, and the latter for the same period to the sum of $6,390.20. It should be specially noted that the former represents *a complete statement of relief paid* during the above-mentioned period, and shows $9,121.68 to have been the total sum distributed among hundreds of needy and, no doubt, many starving strikers with families to support, while $6,390.20 is the sum paid to a very few men whose main business was or should have been the simple distribution of the entire $15,511.88 to the strikers, excepting, of course, such unavoidable but comparatively trifling expenses necessarily involved. The vast preponderance of the sum should certainly have reached the strikers in the form of relief, since it was subscribed for that purpose; in place of which it will be seen that over forty per cent. of the entire sum to be distributed went in expenses. Truly a gratifying showing for the unfortunate strikers.

Let us glance at a few further figures taken from the "Committee Service and Strike Account." The following is an instance of the amounts paid to a single committee-man for his services on the various dates set down:

January 20,	(*Committee service*),	$6 00
October 25,	(on acct. of strike),	6 00
" 26,	" "	25 00
" 27,	" "	7 00
" 29,	" "	5 00
" 30,	" "	5 00
Nov'ber 1,	" "	12 00
" 2,	" "	13 00
" 3,	" "	21 00
" 12,	" "	18 00
" 17,	" "	18 00
" 20,	" "	16 00
" 22,	" "	12 00
" 22,	" "	25 00
" 27,	" "	5 00
" 28,	" "	5 00
Dece'ber 3.	" "	5 00
" 4,	" "	5 00
" 12,	" "	5 00
" 13,	" "	5 00
" 15,	" "	18 00
		$238 00

It will be seen by this interesting showing that leaving out the $6.00 item of January 20th there was paid to this single committee-man during the last three months of the strike the sum of $232.00, or at the rate of $928.00 per year, while taking the amount of relief paid out to three example strikers for the same period we find that they received, respectively, $7.00, $12.00 and $24.00, or an average of $14.33 each, which would give each striker the annual income of $57.32, as against the committee-man's $928.00.

In view of these facts taken from the organizations' own records, it is no longer a matter for wonder that labor societies generally lack organization and power to carry out their purposes, in spite of their apparent financial strength. With such a showing the marvel is more that they exist at all; but the reflection is irresistibly forced upon the mind that with proper and business-like methods of management applied to their undoubtedly great resources, and amalgamated into an honest, harmonious and well-directed unity, they would prove a power little short of invincible; and the enemy should indeed be strong to hope successfully to cope with them.

THE BOYCOTT.

A MORE dismal failure than the effort to introduce a successful boycott scheme in this country could scarcely be conceived. Within the past eight months in every instance the ringleaders of the various schemes set on foot have come to sad and sudden grief.

Take the present cases, for instance; every man on trial for conspiracy (boycotting) in our courts has been promptly adjudged guilty, with a most exhilarating unanimity, which gives fair promise for the future.

It matters little whether the above cases relate to Mr. THEISS, the beer-garden keeper, or a main line of railway. The principle involved in each is precisely the same, while the infraction of law in both cases is equal. The instance of Mr. THEISS has had its perfect parallel in more than one railway strike of the same nature; and it affords by no means a small meed of gratification that the Empire State, as represented by the New York Courts, should take the only just and proper stand, viz.: that the *boycott* is a crime.

It must be evident to any unprejudiced onlooker that this is a fact. The common law of all civilized nations declares that conspiracy is a felony, and it is plain that the boycott, as lately practiced in New York and other cities, is in its title a mere paraphrase for the first-mentioned crime. Its result is to spread debt and ruin on those who venture to disobey its behests, and, as instances in the last six months show, turn an honest and industrious woman, who works zealously for her daily bread, into a practical pauper.

And why? Simply because he, she, or it differed in opinion from the autocratic view taken by the boycott society on apparently all business questions. The great and controlling rule of supply and demand is not allowed to act by this noble band of revolutionists. On the contrary, they state boldly and distinctly that they are the sole and only arbitrators who are entitled in any way to judge between capital and labor, and, further, that their judgment stands without appeal.

The late results of these lawless efforts towards coercion in New York are, however, most gratifying. So far every man charged with the novel crime of *boycotting* has been convicted, and there is little doubt that all of his companions will follow him; and, better still, that the entire party will have an admirable opportunity to reflect on and renounce their errors within the cool and calming walls of Sing Sing.

It is high time that these general disturbers of public peace should learn a lesson, and it would seem at last that they who have in charge the proper administration of our laws will teach it to them.

EDITORIAL NOTES.

JACOB SHARP, the man of champion energy, would seem to have applied that most valuable business quality where it will do the least good. Mr. SHARP has spared no efforts honorable—or doubtful—to attain his end; yet, after all this feverish effort, he is apparently what is popularly known as "left." A hard fate truly after so great effort; yet by no means discouraging to the unfortunate army of taxpayers.

* * *

THE results of the recent boycott trials in this city would serve to show that force and intimidation in a free country will prove a failure. So far four boycotters are adjudged guilty, and the cheering outlook is that the many to follow will meet with the same legal decision; which will deprive the law-abiding community of their society for the terms mentioned in their respective sentences.

* * *

THERE seems at present to be a comparative armistice in the rate-wars, which, if only permanent, would be an admirable thing. The customary throat-cutting war of rates can only react injuriously upon those engaged in the battle; and eventually indeed can effect good to no one—not even the travelers over the various lines involved. A rate-war is always disastrous to all interested.

* * *

THE late general reports of all companies show an encouraging increase in miles of line built, and improvements generally throughout. In every department work appears to be brisk, and gives encouraging promise of a satisfactory return.

* * *

THE steel-tie question appears to be coming to the front. Recent experiments seem to show that the question of economy, viewed from every side, favors the steel tie. Rust, of course, attacks it, but balancing the loss chargeable to damp against the corresponding damage to a wooden tie, the balance would seem much in favor of the former. Taking it "by and large," as the sailors say, it is more than very probable that in the end the steel or metal tie will prove much the most economical in the long run.

* * *

THE future for steel and iron seems bright and satisfactory. Orders are crowding in, while the prices for production are far better than a short time since, when every ton was turned out at a dead loss.

THE June *Century* is an unusually interesting number. The war series is continued in four illustrated articles: "Stonewall Jackson in Maryland," by Colonel Henry Kyd Douglas; "Harper's Ferry and Sharpsburg," by General John G. Walker; "The Invasion of Maryland," by General Longstreet, and "Antietam Scenes," by Charles Carleton Coffin. Among the remaining illustrated articles in this number are "A Literary Ramble.—Along the Thames from Fulham to Chiswick," by Austin Dobson; part two of "American Country Dwellings," by Mrs. Schuyler Van Rensselaer; "Harvard's Botanic Garden and its Botanists," by Ernest Ingersoll, and "Birds' Eggs," by John Burroughs. A collection of unpublished letters of Benjamin Franklin, edited by John Bigelow, is a valuable contribution to the number, and a beautiful engraving of a bust of the old philosopher is furnished as a frontispiece.

Outing for June is as charming as ever, if indeed we may not say more so. The articles and illustrations are equally readable and attractive, and where everything is so good it is difficult to make an award of merit. Mr. Roosevelt continues his "Ranch Life and Game Shooting in the West," as does Mr. Stevens his account of his trip on a bicycle around the globe, both excellently illustrated. The other features of the issue deservedly add to its attractiveness, and seem to demonstrate the well-deserved popularity which the magazine has so quickly attained.

"POOR'S Directory of Railway Officials and Railway Directors for 1886," is in no way inferior and in many points superior to the former editions of the same work. The present issue is thorough and complete in all respects, and to the man desiring railway information it is a cyclopædia of general and valuable information well worthy the possession of the most scientific.

"CANADA; its History, Productions and Natural Resources," published by the Department of Agriculture of Canada, Ottawa, 1886, is an admirable reflex of the general and material growth of the country for the period included, containing much valuable statistic and general information, in addition to an admirable map of the Canadian Dominion.

THE *Illustrated Graphic News* of Chicago for the 19th, is a thoroughly readable and interesting number. The illustrations and matter relating to scenes and life in Georgia are well conceived and admirably rendered, while throughout the issue is good, both in matter and drawing, the supplement deserving special mention,

Street-Railways.

American Street-Railway Association.

President.—Julius S. Walsh, President Citizens' Railway Company, St. Louis, Mo.

First Vice-President.—William White, President Dry Dock, East Broadway and Battery Railroad Company, New York City.

Second Vice-President.—C. B. Holmes, President Chicago City Railway Company, Chicago, Ill.

Third Vice-President.—Samuel Little, Treasurer Highland Street-Railway Company, Boston, Mass.

Secretary and Treasurer.—William J. Richardson, Secretary Atlantic Avenue Railroad Company, Brooklyn, N. Y.

Office of the Association, cor. Atlantic and Third Avenues, Brooklyn, N.Y.

The Fifth Annual Convention of the Association will meet in Cincinnati, O., on Wednesday, October 20th, 1886.

A JUST STRIKE.

TO fully illustrate the trite and ancient saying that "might is right," it is but necessary to note the almost instant success of the street-car drivers' strike in Minneapolis for the privilege of sitting down. Almost without exception the strikes in the last three months have been actuated simply by either a desire on the strikers' part to show wholly arbitrary power, or by a similar ambition on the part of those having in their hands the management of the various strikes.

In nearly every case as described dismal failure has been the only result. Those having the handling and ordering of the strikes in charge made the egregious error of supposing that merely because the combatant wins in one instance, he is consequently invincible in all. This preposterous deduction was without doubt drawn from the instantaneous success resulting from the great general tie-up of a few months since in this city, when the demand of the dissatisfied employés being simply based on a rock foundation of common humanity as to a fair and reasonable number of hours of work, the public, quick to join with justice, recognized the fairness of the claim, and through that "tower of strength" an ample victory was won.

Instead, however, of recognizing the true grounds of success herein, the army of workers foolishly concluded that the result was effected purely from their own inherent power and strength; and consequently arrived at the absurd conclusion that themselves being inherently and only the sinews of war, they were—irrespective of justness of cause—the stronger of the combatants, and *ergo*, must be the victors.

So unfounded a view, however, cannot long be maintained in face of facts. The subsequent strikes taught the fomentors thereof that without public sympathy any position taken is weak and the cause doomed to failure. No clearer proof could be desired of the truth of this axiom than the dismal distress and failure resulting from the last Third Avenue strike, where the grounds of complaint were utterly without strength or justice.

There are, however, two sides to this question. Just as above mentioned, the strikers made the grave error of mistaking for inherent strength the success which in the first instance was theirs simply through public sympathy, so in the latter, the companies are plainly falling into the same grievous error. It is reported that on our local roads that managers, encouraged by recent strike-failures, are contemplating restoring working hours, etc., to the old ante-strike standard. This would be a grave error; for, as we have said before, the whole question of success in strikes balances on the scale of public opinion.

This is plainly shown in the instance we employ to illustrate our point. The Minneapolis drivers struck for the privilege of sitting down when duty permitted. Herein they were in the right, and being right had with them public sentiment, which resulted in inevitable victory.

The strikers were out scarcely twenty-four hours when they accomplished an unconditional triumph, simply through their claim having justice on its side. The moral is so plain that it seems almost superfluous to give it life in type; still, to recapitulate, we see that be the party employer or employed, to gain success requires the grand desideratum of *right*, thereby winning to its side that greatest ally—*public*.

THE city appears to have at last forced the Broadway surface road to a payment of $40,000 for its share of profits. The sum is small enough in all conscience, but the present handlers of the road made as strong a fight as if resisting a most outrageous piece of oppressive municipal power. To the uninitiated it is amazing that such a question should be so long in dispute, but, perhaps, it may be as well to avoid useless controversy, and be thankful for small favors. Compared to former times, at any rate, the result is not so bad.

* * *

ALL street-car lines at present seem strangely quiet after the war-like attitudes so lately assumed by the workmen thereon. Experience seems to have taught the folly of attempting to enforce an unjust demand; and if this fact be really learned, the strikes of the last six months will have fairly paid their way.

* * *

THE movement lately started to make all fares on the "L" roads five cents at all times, is well worthy of consideration. The elevated roads have proved of vast good to the town, and while no one desires in however slight degree to curtail a fair profit from the stockholders, yet experience has shown that every similar projected change has been met with a like outcry and opposition on the

part of those supposed to be principally interested. In spite of all this, when the public has downtrodden all opposition, strange to relate, in a month or two the roads themselves have become quite reconciled to the change, and their books show no decrease in profit. Might it not be as well to keep these facts in mind when the question is again to the fore? Certainly it would seem so.

* * *

JUDGING from the newspapers it would seem that Mr. RICHMOND is selected as the sacrifice at the next court festival, to the utter exclusion of the ambitious Mr. SHARP. This, so far as it goes, is gratifying, but scarcely poetic justice, since reports say on good authority that the redoubtable Mr. S. has been religiously stricken, and, consequently, feeling the unfitness of his former associates, has arrived at the conclusion that so far as he personally is concerned, they represent the historical JONAH. Like any good business man under similar circumstances he promptly fires them overboard. While one may heartily regret the success of the scriptural device, we still may hold one comforting reflection: JONAH'S gone overboard.

LABOR AND THE STREET-RAILWAYS.

BY L. CHRIS. HENDERSON.

[Written for the AMERICAN RAILROAD JOURNAL.]

THAT the country is in an extremely critical condition seems to be acknowledged on every hand. The recent strike in New York and Brooklyn, which paralyzed for a time nearly all the internal communication of the two cities, demonstrated at once the strength and the weakness of the labor organizations. That the union was able at a word to tie up all the roads without an exception worth mentioning, demonstrated an almost unsuspected power in the unions. But the result of this strike has been to greatly weaken the union and lessen the faith of the men in their leaders.

The possibilities of the labor union, as shown in the recent troubles, are beyond the wildest dreams which have been painted by sanguine authors in the past. Nothing which Charles Reade described in "Put Yourself in His Place," is impossible; indeed the worst appears to be more than probable.

In case the Knights of Labor fall into the hands of the politicians, it seems highly probable that their methods will become legalized, although the Knights will, like other organizations of the kind, be sold out to the highest bidder.

The injury which will result to the community from such a result is hardly to be calculated. Even a very partial success will be little less than a social revolution. An entire accomplishment of the schemes now under consideration would involve consequences of which we cannot now form any conception.

Reading the history of the last twenty years in the light of recent events, it would seem that the close of the 19th century was to see a repetition of the conditions which preceded the terrible outbreaks at the end of the 18th century. Whether these conditions shall be productive of a social and political volcano, or of a new and better order of things, depends largely upon the men who are now handling capital and employing labor. While the conservative and wealthy are the most numerous in the community, it unfortunately happens that the weapons in the hands of the minority are most powerful and deadly, and against them no shield nor armor has as yet been devised.

One of the living questions with which street-railway capital finds itself called upon to answer is, "Can our relations with labor be changed for the better?" "Can these new relations be made mutually profitable?" Evidently things cannot go on as they are. These great strikes will probably end in such a large and general reduction of wages, that the men will be upon the point of starvation. With the voting power and dynamite in the hands of such men the results are not pleasant to contemplate.

If capital undertakes the matter in earnest, cannot these men be enabled to earn more money? Cannot such inducements be held out to them that they will have a selfish personal interest in the success of the roads on which they work, and at once be protected from the evil influences of the demagogues and made powerful allies of their employers.

That there are good men who are worth a large percentage more than others every superintendent knows. And it is generally acknowledged that improvement is possible to most men. Is it not possible then to devise some scheme which will permit the companies to pay higher wages, and, at the same time, to get a corresponding increase of value from their labor. If this is not possible, cannot means be devised for improving the condition of the men and making their positions more valuable to them. By means of large capital much may be done at a very small expense. Whatever tends to raise the social condition of the men is of as great benefit as that which is purely monetary. The plan adopted on some of the eastern roads seems to have the germ of an idea which is widely applicable, and which may result in great good both to the companies and men. The plan is to gradually advance wages according to the length of service. In this way old and faithful employés have a very material advance over those who are just beginning. This idea of recognizing long and faithful service in a substantial way has a strong beneficial effect upon men of all classes.

Since writing the above Mr. Hart, of the Third Avenue road, in this city, has announced that the strike on his roads is practically at an end, and he says he thinks it highly improbable that any further trouble will be encountered. The Third Avenue strike has undoubtedly broken down, but it by no means follows that the end of the trouble has been reached. This particular company may be in such a position that for some years to come their men cannot be induced to enter the union. This, however, is not an end of the trouble. The enormous power in the hands of the Knights of Labor has been demonstrated, and it cannot long escape the grasp of some really able and powerful man. In such hands the country cannot long escape the worst results.

While individual roads may, for a time, put such a

pressure on their men as to remove them from the influence of the labor organizations, they cannot do this for any considerable period if their present policy toward their men is continued.

The question which the companies are now facing is whether it is not expedient to employ means which will permanently take their men beyond the reach of the unions and labor organizations, rather than to allow things to go on in the old way regardless of the evils which are impending.

HONESTY.

BY E. P. WILLIAMS.

[Written for the AMERICAN RAILROAD JOURNAL.]

AT one of the meetings of the Street-Railway Association Mr. White, the well-known street-railway man, spoke of the need of teaching the public honesty. He spoke of the wide-spread tendency which he found to beat the company out of five cents whenever it was possible to do so. While this is no doubt a crying evil, would it not be well for the companies to set the example of honest dealing? The passenger now and then cheats the road out of a fare, but the roads are prone to cheat the public. One of the most flagrant examples of petty cheating is to be found on the Grand Street line in New York City. This road runs to the Grand street ferry, and, in wet weather, is heavily patronized by those who wish to cross the river. At the busy hours at night instead of going to the end of the line the cars stop and the passengers are obliged to get out from one to two blocks and of en three blocks away from the ferry houses. There are, no doubt, good excuses in the minds of the managers, but every passenger feels himself aggravated and swindled when the car stops two or three blocks from the ferry, and he is obliged to walk in the rain a portion of the distance for which he has paid a fare. There is an old and very trite saying about charity beginning at home. Perhaps if our railway companies were more strictly honest in their dealings with the public, they would have less difficulty in preventing the public from "beating" them out of these fares. Injustice on the part of a corporation in the end is punished by the public. Commonly, the punishment is much out of proportion to the cause, and the corporation has to pay dearly for its errors.

Electricity in Ireland.

AN electric railroad has been in successful daily operation in the north of Ireland since November 5, 1883. It starts from the railroad terminus of the Northern Counties Railway, at Portrush, in the county of Antrim, and runs along the magnificent coast road to Brushmills, a distance of six miles, ending within a short distance of the Giant's Causeway. The total length of the way, including the branch way, to the harbor of Portrush, and the several sidings, is upward of seven miles. The road is one continuous series of long inclines. Grades of one in forty-five and one in forty are frequent for upward of a mile in length, while steeper grades of one in thirty exist for shorter distances, the worst grade being one in twenty-five. The summit level occurs about midway, at an elevation of about 160 feet above either terminus, the total rise from the depot at Portrush to the summit being 203 feet. Some sharp curves exist along the line, the worst one having a radius of about forty feet. There was some doubt in the mind of Sir William Siemens, the constructor of the line whether with the arrangements adopted these inclines could be worked satisfactorily; but experience has proved that they can be, and the car, when fully loaded, is drawn up the grades without difficulty. There are seven "passing places" along the line, where the "points" are set so that the cars traveling in opposite directions always take their own sides respectively.

At first the power was produced by a steam-engine at Portrush, giving motion to a shuntwound dynamo of twenty horse-power, but arrangements were subsequently made to utilize a waterfall of ample power on the river Rush, situated sixteen hundred yards from the nearest point of the tramway and six and a half miles from Portrush. A fall of twenty-six feet head of water is used to drive two turbines each capable of working up to fifty-two horse-power.

A speed of ten miles an hour is readily obtained. Mr. Traill, the Engineer of this road, told the Inventors' Institute last year that, after repeated failures, they had at last hit on a thoroughly trustworthy plan for getting electricity from the conductor. This was by means of a steel spring in the form of a carriage spring. Two concave steel springs were fastened at the top and rubbed along the bottom. His cars had then successfully traveled over 30,000 miles with 100,000 passengers. The cost of electricity generated by water power a mile distant was one-quarter that of steam used on the same railroad.

It is said that the construction of this road cost $225,000; that it is paying a 12 per cent. dividend, and that the working expenses are five cents per train mile. An extension of six miles is contemplated.—LAKE, in *Electric Railways*.

A New Cable System.

THE *Railway Reporter* says: "Charles W. Rasmusen, of Chicago, who has just been sent to an insane asylum after a long spell of sickness from typhoid fever, is the inventor of a cable system for street-railways, which, although it has not been practically tested, it is said, is radically different from the one in use in this city, or anywhere else, and can be constructed at a minimum of cost. The Rasmusen system may be thus briefly summarized:

"Any existing track is available throughout, no change being necessary. No interference with public traffic, and no loss of revenue is caused during construction, the channel for the travel of the cable consisting merely of a tube six by nine inches, which can be laid at the rate of one mile per day, and consists of three sections of rolled iron plate spiked to the cross-ties. The city sewer, gas or water pipes are in no instance displaced, and only one man-hole for each 300 feet of double track is necessary. No extra cars or grip-cars are required, the ordinary street-car being available, either closed or open, as the season may require. The operator stands on the front platform, having the entire roadway ahead in view, enabling him to see passengers and avoid accidents. One hand-wheel operates both grip and brake. At the same

turn of the hand-wheel the cable is released and the brake on the car-wheels applied, or *vice versa*. The cable is always in direct line; there is no downward strain on the car, but it runs as easily as a horse-car, while the grip in the present system must, in order to pass the stationary pulleys, lift the cable nine inches above its direct line of travel, causing a downward strain, which causes the car to run heavily and pound on the rail-joints. No extra supervision or care is necessary to connect the car with the cable at starting points or sections, and it is impossible to miss the connection. Any man who can turn an ordinary hand-wheel is sufficiently skilled to run the cars. As the cable is not gripped it will not get stranded, besides which, the trucks being clamped firmly to the cable every sixteen feet add considerably to its stability. No stationary pulleys are used, but in their stead a two-wheeled truck is clamped direct to the cable and travels with it. The highest estimated cost of construction is $14,000 per mile. The nature of the surface does not change the cost. The cost of construction of the present system in Chicago is reported by the president to have been $105,000 per mile of single track."

Snow in London.

ACCORDING to a late issue of the *Street Railway Journal*, the Londoners who go to pieces badly on a fall of five or six inches of snow, are very much pleased with the working of the cable road they have: it was about the only mode of locomotion, except the underground, that was not interrupted during their late storm.

Iron asserts that they ran without difficulty and that the superintendent wished for more snow so that he could show what he could do, and that on Highgate Hill, grade 1 in 11, where teams of six horses could not pull four tons, the vehicles were attached to the cable cars and were drawn up without difficulty.

This is in effect the same experience had last winter in Chicago, until the shaft of their winding engine broke down. In spite of the intense cold, and drifts, said to have been six feet deep, the cable pulled the cars steadily through, until the four 24 x 48-inch cylinders twisted off the shaft of their winding-drums. This year they have added two 30 x 60-inch cylinders and strengthened their shaft, proposing to pull their cars through anything that any blizzard may bring.

The difficulty experienced by street-railways with a heavy snow storm, and the continual fight existing at all times regarding the use of salt, renders any suggestion for the lessening of the trouble, of interest. In Vienna, which although far from being a model of cleanliness, there is a system in use for the removal of snow that is worth copying, as the rapidity with which the work is accomplished is truly remarkable.

An Electric Motor.

A DECIDED departure from the practice hitherto followed in the construction of electric machines for working tramways has recently been introduced in an electric locomotive on the London (England) North Metropolitan Tramway, by a Mr. Elieson. The London *Times* refers to this new device as follows: "Instead of the electric motor being a fixture, and having motion transmitted from it through belt gearing to the wheels of the car, the motor itself revolves, the motion being transmitted through bevel gearing. The system is the invention of Mr. Elieson, and the locomotive has been built by the Electric Locomotive and Power Company, of London. The locomotive is similar in appearance to a short tram-car, and carries a secondary battery, consisting of fifty cells. This battery is connected up with the electric motor, the motion shaft of which projects horizontally about two feet, and carries at its end a spur-wheel, which gears into a fixed circular rack. Thus when the motor is started it is, by means of this gearing, rotated. A vertical shaft is attached to the under side of the motor, carrying at its lower end a bevel-wheel which gears into one or other of two similar wheels on the driving-axle of the engine. The mitre gearing is fitted with a friction-clutch, by means of which the locomotive can be run either backward or forward. The fifty cells are equal to 280 amperes, and as the average consumption is stated to be forty-five amperes per hour, it follows that there is a good six hours' supply of power carried. The machinery is so arranged that a speed of eight miles an hour cannot be exceeded. Both the locomotive and the tram-car can be electrically lighted at night from the battery by means of glow lamps. We recently inspected the working of this locomotive at the tramway company's depot at Stratford, which was satisfactory in the limited space at command. It was started, stopped and reversed very readily. The machinery is of a simple character, and can be adapted to the tram-car itself in new stock. The electric locomotive company are building a more powerful engine, in order to demonstrate the application of the system on railway lines."—*Street-Railway Journal.*

Glanders and Farcy.

ACCORDING to the *Scientific American* the Tennessee State Board of Health in its bulletin for March, commends the health officer of Nashville for his prompt destruction of three animals affected with glanders.

The board calls the attention of other local authorities to the importance of the immediate destruction of all animals affected with the disease. Glanders and farcy are two names denoting really one disease, due to the same specific poison. It is called glanders when the air passages are affected, and farcy when the skin, areolar tissue, lymphatics and glands are most prominently involved. Damp, ill-ventilated, narrow, and ill-built stables, insufficient or unwholesome food, and excessive fatigue are the principal predisposing causes to the development and propagation of the disease. It invariably terminates in death, whether it appears in the acute or chronic form. Its communicability from one horse to another, from the horse to man, and from man to man, is now no longer questioned; hence health officers should act with great promptness in every case, rigidly enforcing isolation in regard to all "suspects" and extermination of all animals known to be affected.

The German law directs that any horse which has been *even in contact* with a glandered animal shall be *immediately* killed. This is wise. When the horse is killed, it should *at once* be buried deep in plenty of lime, and its

former habitation thoroughly disinfected, first with sulphurous acid fumes, followed by prolonged free ventilation. All tainted food, bedding, etc., should be speedily burned.

The Berlin City Elevated Railroad.

THE Berlin City Railroad (elevated) has been in operation four years, crossing the city from east to west and being a thoroughfare for through and suburban trains as well as for purely city traffic. The purely city trains are 280 daily; the suburban 74, and the others 90, so that 444 trains are dispatched daily. It is a four-track road on a solid masonry viaduct. On summer Sundays 72 extra trains are sometimes run, and as many as 562 have been dispatched in one day. (There have been more than 800 regularly on a double-track line of the New York Elevated.) The number of passengers on the Berlin road was 8,396,460 the first year, and 14,256,490 in 1884-85. The four New York elevated roads carried 103,354,729, and of these 48,399,496 were carried by the Third Avenue line, which is about 8½ miles long. From 400 to 500 employés are engaged on the Berlin road and 54 locomotives are constantly in service.

Obligatory Arbitration.

THE principle and the method of voluntary arbitration are best suited to our country, but it is going beyond the record to assert, as a contemporary does, that "compulsory arbitration is an absurdity—there is no such thing." The French arbitration laws, as we have heretofore shown, have been in operation since the time of Napoleon. Under them arbitration is compulsory, on the application of either party to a dispute, and the decisions of the boards or courts organized for this purpose have the same force as those of courts of law. They are constituted by the authority of the Minister of Commerce, through the chambers of commerce, which are established at important trade or manufacturing centers, says a recent writer on this subject, and are composed of "an equal number of employers and workingmen members, each class electing its own representative, with a president and vice-president named by the government." The authority of these boards extends to every question that can arise in the workshop, with one exception—the future rate of wages; and "even this can be done by mutual agreement." More than 90 per cent. of the cases brought before them are settled by agreement. Forty years ago, according to another writer, there were sixty-nine councils called into existence in one year, which had nearly 20,000 cases before them, and in only 529 cases was it necessary to have formal judgment, the others being settled by "conciliation." Of the cases brought before the councils in 1878, 21,368 were relative to wages, 4,733 to dismissals, and 1,795 to apprentices. In 1883, a year of unusual disturbances, the great number of 263,000 cases were considered by these tribunals, "and with very few exceptions, satisfactorily adjusted by them, thereby avoiding an untold number of possible strikes and lockouts." As suggested by Mr. Carnegie for this country, pending arbitration, work and wages go on, the award taking effect from the time the inquiry begins. The councils, it is added, are usually presided over by "lay judges," tradesmen, manufacturers or merchants, aided by clerks experienced in these hearings. In troubles relating to railways, either horse or steam, or to other enterprises involving the needs and convenience of the public, a little compulsion toward a settlement may yet be found necessary in this country.—*Boston Herald.*

The Suburban Rapid Transit Railroad.

NEW YORK is opening another avenue to success in rapid transit in the Second Avenue Elevated Railway. With the title of the Suburban Rapid Transit Railroad, it runs away across the Harlem River to a thickly settled region, upon a new bridge, an airy iron way towering high above the earth, and gradually diminishing brick piers. It is safe and swift, and has reached 134th street now. In less than a month it will be at 143d street.

STREET-RAILWAY NEWS.

ALABAMA.

THE Capitol City Street-Railroad Company, of Montgomery, is so satisfied with the working of one of its lines by electricity after a month's trial, that it has contracted with the Van De Poele Electric Manufacturing Company, of Chicago, to equip all the lines. This will be the first city in the States to have all its street-cars run by electricity.

The Elyton Land Company's Boulevard street-railway has recently been opened. The line runs through the Highlands, connecting the town with that suburb and Lakeview Park. The line is to be worked by dummy engines.

At Birmingham a street-railway company is to be chartered by J. C. Westbrook and others.

FLORIDA.

The Palatka Street-Railroad Company has been incorporated.

GEORGIA.

The Macon Street-Railway is to be double-tracked as far as possible, and a large number of switches are to be put in to do away with the present delays.

The Metropolitan Street-Railroad Company, of Atlanta, has commenced giving concerts at Grant Park, to which place its cars run.

ILLINOIS.

The Chicago Passenger Railroad Company has completed its extension east to Wabash avenue, and will soon be completed west to Michigan avenue.

The West Side Street-Railroad Company, of Chicago, has nearly completed its West Division street line.

The North Chicago Street-Railroad Company's system is to be converted to a cable line. The road was purchased recently by Mr. Charles Yerkes and others, of Philadelphia.

The Chicago Electric Elevated Railroad Company has been incorporated to build a line from the center of the town to Hyde Park, Union Stock Yards, Riverside, Brighton Park, Evanston, etc. Capital, $5,000,000.

The Ottawa Street-Railroad Company has been incorporated by Frederick A. Sherwood and others. Capital stock, $30,000.

INDIANA.

At Logansport the street-railway company has petitioned the council for the exclusive power to use electricity or hot-air as tractive power. The company intends to do away with mules.

MASSACHUSETTS.

At Boston the Meigs elevated line has been successfully tried before a legislative committee; the train passing the sharpest curve and the heavy grade of 345 feet to the mile with perfect ease.

At Gloucester the car-stables are nearly completed and cars are running between Eastern Point and the depot.

The Natick and Cochituate Street-Railroad Company has elected the following directors at its first annual meeting: Harrison Harwood, William H. Bent, George S. Trowbridge, O. A. Felch, Frank H. Hayes, George F. Keep, and John O. Wilson.

The Naumkeag Street-Railroad Company has opened its branch to Wenham.

At New Marlboro the Konkapot Railroad Company is to be incorporated. Capital not to be less than $50,000, nor more than $150,000.

The proposed street-railway between Adams and North Adams has been abandoned.

MICHIGAN.

The Battle Creek Street-Railroad Company has been incorporated by H. H. Brown, Lucius Clark, South Bend, Ind., and H. C. Miller, Chicago. Capital, $35,000.

At Detroit a company has been organized to build a street-railway from the end of the Congress street line to the suburban town of Springwells. The line is to be worked by electric motors.

MISSOURI.

The Kansas City Cable Railroad Company has elected the following officials: President, W. J. Smith; Vice-President, P. A. Chase, of Boston; Secretary, W. H Lucas; Chief Engineer, Clift. Wise.

At St. Louis the Mallinckrodt brake is being experimented with on the Fifth street line. The driver can stop gently on ordinary occasions, but upon emergency can stop the car in from three to six feet.

NEBRASKA.

The Omaha Tramway Company has decided to build two miles of line at once and to erect a building for the plant.

NEW HAMPSHIRE.

At East Manchester the street-railway is to be extended along Hall and Park streets to Massabesic street.

At Nashua the street-railway company has held its first annual meeting and reëlected the same board. The cost of construction has been $16,350. The tracks are now laid to the railway depot.

NEW JERSEY.

The cars will be run as usual on the Beach Point Railroad, the difficulties which threatened the road having been disposed of.

NEW YORK.

The Arcade Railway Bill has received the Governor's signature. There are to be four standard-gauge tracks, and the cost is estimated at $40,000,000; the road is to be completed in five years. Electricity will be the motive-power.

The Broadway Railroad Company's charter has been canceled. The president of the company has resigned and Mr. O'Brien has been appointed receiver, but the directors refuse to recognize his authority; he has not ordered the taking off of the cars, out of regard for the public convenience. Interesting legal operations are pending.

The Suburban Rapid Transit Company has opened for traffic the first mile of its road, including the new Second avenue bridge.

The Tenth avenue cable cars are expected to be running to Eighth avenue soon, avoiding the present change from horse to cable traction at Tenth avenue.

The Atlantic Avenue Railroad Company, Brooklyn, has been authorized to purchase the Prospect Park and Coney Island Railroad.

The East New York, Bay Side and Ozone Park Railroad Company is about to lay its tracks in New Lots, L. I.

A street-railway is to be built between Valatie and Niverville. For particulars, inquire of L. Sniffen, of Valatie.

OHIO.

At Cincinnati work has been commenced on the cable road trench at Fountain square. Work is progressing at the Walnut Hills end of the line.

PENNSYLVANIA.

The Germantown Passenger Railroad Company stockholders are dissatisfied with the management of that corporation by the People's Company, and propose to contest for control of the board at the annual meeting. A compromise may, however, be effected.

The Scranton Suburban Railroad Company has been incorporated.

WISCONSIN.

At Eau Claire the street-railway is to be extended, one extension is to be in the sixth ward on account of the rapid settlement of that district.

At Neenah work on the street-railway has been delayed by the keeping of the rails at Bay View, owing to the strike. It is not yet decided whether the line will be worked by electricity or horses.

CANADA.

The Montreal City Passenger Railway Bill has been passed, including power to erect an elevated road.

At Toronto the street-railway strikers have started stage lines. On May 25th the mob wrecked 40 cars.

FOREIGN.

The city of Glasgow (Scotland) owns fourteen miles of street-railway, which bring an annual rental of $76,000. The fare is two cents per mile, with reduced rates morning and evening when the working people travel. The original purpose of the system was to enable workingmen to reside in the suburbs.

At Singapore (Straits Settlements) the surface railway from Tanjong Pagar to Elgin bridge was opened by the Governor on April 21st. The line is worked by steam and there are 20 engines by Kitson & Co., Leeds, Eng., and 20 cars by the Saltley Car and Wagon Company, Birmingham, Eng.

New Inventions.

Unangst's Railway Alarm-Signal.

HENRY S. UNANGST, of Phillipsburgh, N. J., is the inventor of a new and improved form of railway alarm-signal, the construction and operation of which is herewith illustrated and described. The invention relates to an improvement in railway alarm-signals for low overhead-bridges, designed to give an alarm to brakemen on top of freight-cars before approaching a low bridge; and it consists in the peculiar construction and combination of parts hereinafter shown and set forth.

In the accompanying cuts, Fig. 1 is an elevation view of a railway-signal embodying the invention; Fig. 2 is a perspective view of the same, and Fig. 3 is a horizontal section on the line *x x* of Fig. 2.

A represents a vertical post of suitable height, which is located on one side of the railway-track, and is provided near its lower end with a bracket or bearing B, in which is journaled one end of a horizontal shaft C. The other

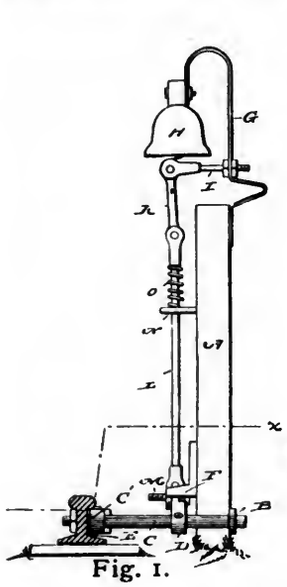


Fig. 1.

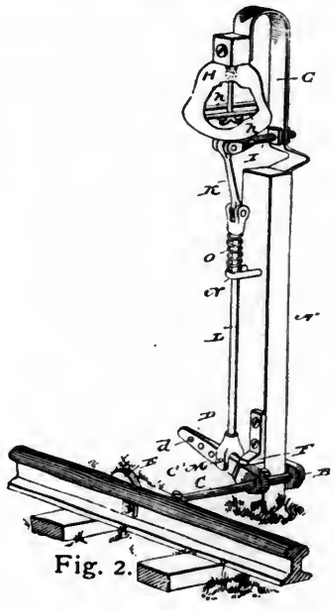


Fig. 2.

UNANGST'S RAILWAY ALARM-SIGNAL.

end of the said shaft is journaled in a transverse opening, which is made in the web of one of the railway-rails, and the said shaft carries a tappet-arm C′, which bears against the outer side of the track, and also a lever-arm D. To the outer end of the tappet-arm is journaled an anti-friction roller E, the upper edge of which extends normally a slight distance above the upper side of the rail. The lever-arm D, is provided with a series of transverse openings *d*. A stop F, is secured to the inner side of the post A, near the lower end thereof, and limits the upward movement of the lever-arm D. To the upper end of the post A, is secured a flat spring or arm G, which is bent in the form shown in Fig. 2, and has a bell H, secured to its free upper end. The clapper of this bell moves in guides *h*, which prevents rotary movement of the clapper, and insures its striking against the side of the bell and sounding an alarm. An arm I, is secured to the spring G, at a point above the upper end of the post, and to the outer end of the said arm is pivoted a link K. The lower end of this link is connected to a vertically-movable rod L, the lower end of which rod is attached to the lever-arm D, by means of a transverse pin or bolt M, which passes through the lower end of the rod L, and through either of the series of openings *d*. The rod L, is guided by a keeper N, which is secured on the inner side of the post, and the said rod is provided at its upper end with an extensile coiled spring O, which bears between the keeper and a shoulder formed on the rod. The function of this spring is to keep the lever-arm and tappet-arm normally raised in the position shown in solid lines in the cuts.

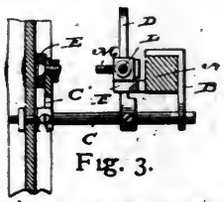


Fig. 3.

UNANGST'S RAILWAY ALARM-SIGNAL.

This signal is erected at some distance from a low overhead-bridge or other dangerous obstruction, and when a train approaches, its wheels, by passing over the friction-roller at the outer end of the tappet-arm, causes the said arm to be depressed, and thereby sounds the bell. As each wheel passes over the friction-roller the tappet-arm and lever-arms are raised by the resilience of the spring O. By adjusting the bolt M, in or out on the lever-arm the stroke of the bell may be regulated. The clapper of the bell may be preferably hung on a pivot, in place of by the two interlocking eyes as shown in Fig. 2, which gives better results.

It is claimed by the inventor that a railway-signal thus constructed, is automatic, simple, economical and thoroughly reliable, and perfectly answers the purposes for which it is required.

McNally's Wrench.

AUSTIN MCNALLY, of Cascade, Iowa, is the inventor of a new and improved form of wrench, which is herewith illustrated and described. This invention relates to improvements in nut-wrenches; and it consists in the details of construction and novel combination of parts fully set forth and shown below.

In the accompanying cuts, Fig. 1 is a perspective view of a wrench constructed in accordance with the invention; Fig. 2 is a side view of the same, partly in section; Fig. 3 is a perspective detail view of the pivoted and sliding-jaws.

The stock A, is of the usual form in cross-section, and is provided with a handle B, and ferrule C, at the junction of the handle and stock. The jaw D, has an opening *d*, formed longitudinally therethrough for the reception of the head of the stock, which is secured therein by a pivot *d*′. The opening is of sufficient size to permit of a slight vibratory motion of the jaw, for the purpose presently set forth. Wings D′, extend from the jaw D, on each side of the stock and terminate close to the ferrule. These wings are slightly wider than the stock and are of a uniform width throughout their length. A clip E, uniting the lower ends of the wings, is provided with a socket E′, on one side and a cam-lever F, on the other or opposite side, which lever is pivoted between the ends of the clip, and of a width to bear on the upper side of the stock.

The sliding-jaw G, is held in place on the wings of the pivoted jaw by hooks H. This jaw has a movement to and from the jaw D, on the wings D′, which form guides, and a second movement to and from the stock as the jaw D, is vibrated about its pivot. The jaw G, has an extension G′, which rests on the edges of the wings. Teeth *g*, on the face of the extension G′, adjacent the stock, are adapted to engage a tooth or teeth *a*, on the under side of the stock, thereby preventing the further movement of the sliding-jaw during the contacting of the teeth on the two parts.

The cam-lever, when thrown in the position shown by full lines, Figs. 1 and 2, draws the jaw G, into closer relationship with the stock, thereby causing an engagement of the teeth on the jaw and stock, as will be readily understood. The lever, when thrown in a position parallel with the stock, permits the moving of the jaw D, on its

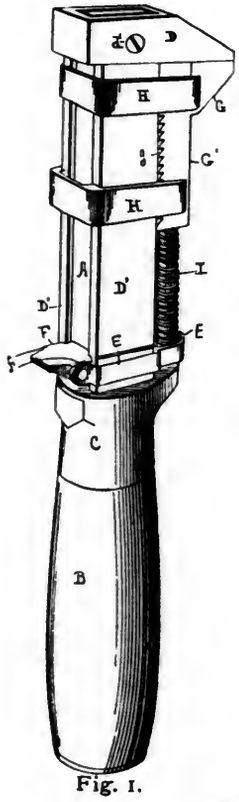


Fig. 1.

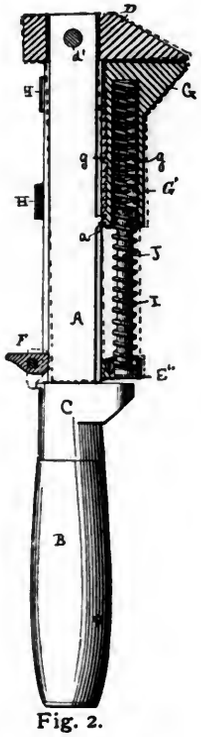


Fig. 2.

MCNALLY'S WRENCH.

pivotal connection with the head of the stock and leaves the jaw G, free to be moved to and from the jaw D, as desired. The jaw G, and its shank have a longitudinal bore *g′*, formed therein, and a coil-spring I, seated in said bore, extends to and finds a seat for its protruding end in the socket E′. A bolt J, having its head resting in said socket, passes through the spring and projects part way on to the bore *g′*, of the jaw G, when the latter is closed, as shown more clearly in Fig. 2. The spring rests on the head of the bolt and prevents the latter from becoming displaced.

The spring always exerts a force to keep the jaws closed; hence when the jaw G, is disengaged from the stock by the cam-lever said spring will carry the jaw up against the jaw D. The cam-lever, when it occupies a position at nearly right angles to the stock, locks the jaw in place, and to prevent the lever from turning too far wings *f*, projecting beyond the ends of the clip E, engage the sides of the same, which form a stop to limit its further movement. In practice the device may be used as a self-adjusting ratchet-wrench by throwing the lever in the position indicated by dotted lines, Fig. 2, and full lines, Fig. 3, or by dispensing with it altogether. In this case the jaw D, is free to vibrate on its pivotal connection with the stock, thereby engaging and disengaging the locking-teeth between the longitudinal moving jaw G, and the stock A. When thus disengaged the spring I, forces the jaw G, up close to the jaw D.

The above conditions being borne in mind, the following operation will be readily understood. The wrench

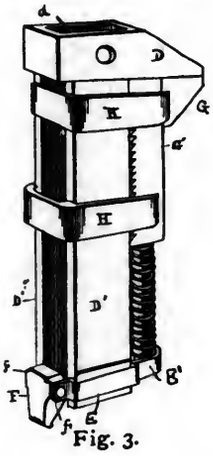


Fig. 3.

MCNALLY'S WRENCH.

being adjusted to any desired nut, a backward movement of the handle will disengage the interlocking teeth between the jaw G, and the stock, and a continued backward movement will cause the jaws to separate and ride the edges of the nut, which, having been passed over the spring I, will cause the jaw G, to advance and come close against the sides of the nut, the handle being now moved forward or in a reverse direction, the teeth between the jaw G, and stock will interlock and cause the nut to follow its movement.

It is claimed for this form of wrench that it is simple, durable, and economical in construction, and while of great power is readily and quickly adjusted to any nut within its gauge, giving a sure and powerful grip, without risk of slipping.

All inquiries and communications should be addressed to James A. Hayes, of Cascade, Iowa, to whom a one-half interest in the device has been assigned.

Shank's Car-Coupling.

JOHN SHANK, of Las Vegas, New Mexico, is the inventor of a new and improved form of car-coupling, which is herewith illustrated and described. This invention relates to an improvement in car-couplers. consisting of an ordinary draw-bar provided at its upper forward part with a pin-box and forwardly a projecting piece so disposed as to hold the link, and within the opening of the draw-bar a tongue having a suitable spring, so that the link may be be held in a horizontal position while in the act of coupling, all of which will now be fully set forth in detail.

In the accompanying cuts, Figs. 1 and 2 are sectional

views of a pair of car-couplers, showing the improvement thereon; and Fig. 3 a perspective view of the same.

A represents an ordinary draw-bar provided at its upper forward part with an upwardly-projecting pin-box B, of any suitable length.

Extending forward from the central opening C, of the pin-box, to receive therein the ordinary coupling-pin D, an opening E, is provided immediately over the connection of the said pin-box with the upper face of the draw-bar. Within this opening E, is provided a forwardly-projecting slide F, having its forward end G, upturned, forming

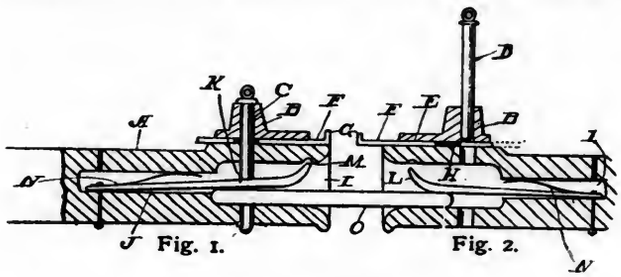


Fig. 1. Fig. 2.

SHANK'S CAR-COUPLING.

a lug, or a kind of a bumper. When this slide F, is drawn out, as shown in Fig. 2, the pin D, rests upon its rearward end, while immediately forward of the part upon which the said pin D, rests is an opening H, so that when the said slide is pushed rearwardly, as shown in Fig. 1. the pin D, will drop through this said opening. Within the usual opening I, of the draw-bar is provided an upwardly-projecting tongue J, secured rearwardly within the said opening. This tongue is provided with an opening K, immediately beneath the pin-box B, so that the pin D, may pass through, but not interefere therewith. The forward end of this tongue J. is upturned, as shown at L, so that when in use it will rest within the slight recess in

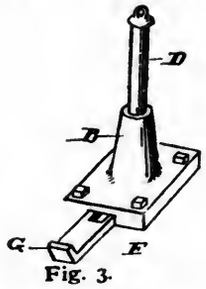


Fig. 3.

SHANK'S CAR-COUPLING.

the upper wall of the opening I. A spring N, is placed rearwardly within the opening I, upon the upper side of the tongue J, so that the normal position of the spring will be nearly horizontal, with the forward end pressing down upon the one end of the link O, sufficient to hold this said link nearly horizontal.

The opposite draw-bar, as shown in Fig. 2, has its sliding piece F, upheld out, with the pin D, resting upon its rear end. Then, as the draw-bars approach each other, as soon as the link O, enters the draw-bar the bumper G, of the sliding piece F, striking the opposite draw-bar, releases the pin D, when it drops down into the draw-bar and secures the link O, in position.

It is claimed for this form of car-coupling that it is simple, strong and economical, and can be readily attached to any ordinary form of car; while it will couple either on grades or curves.

The device is under the sole control of the inventor, to whom all inquiries and communications should be addressed.

Dickinson's Rotary-Chair for Railway-Carriages.

HENRY C. DICKINSON, of Springfield, Mass., is the inventor of a new and improved form of rotary-chair for railway-carriages, which is herewith illustrated and described. This invention relates to improvements in rotating chairs for railway-carriages and in means for operating the same; the object being to provide for railway and other carriages an improved rotating-chair and means for simultaneously rotating all of the chairs on one side of a car, to cause them to face in opposite directions.

In the accompanying cuts, Fig. 1 is a side elevation illustrating a portion of the inner side and the floor of a railway-car, and showing attached to the latter a chair and rotating mechanism connected therewith embodying this invention, the stand on which said chair is supported being shown in vertical section, and the chair-operating bar being shown broken off at the ends; Fig. 2 is an interior end elevation of a portion of a car, showing the

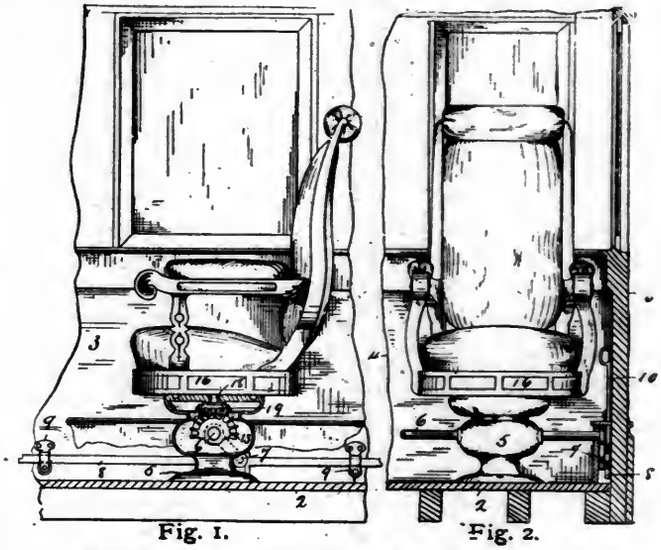


Fig. 1. Fig. 2.

DICKINSON'S ROTARY-CHAIR FOR RAILWAY-CARRIAGES.

side wall and the floor thereof in section, and showing the revolving chair in front elevation, and a portion of the operating mechanism for rotating the latter, hereinafter fully described; Fig. 3 is a front elevation, partly in section, of a pair of seat-frames, their stands, and mechanism for rotating said frames; Fig. 4 is a perspective view of portions of two of the chair-rotating shafts and the mechanism by which they are given a reciprocating rotary motion; Fig. 5 is a plan view of the top of the seat-frame, and Fig. 6 is a plan view of the top of the chair-stand.

In the cuts, 2 indicates a portion of the floor; and 3, of the side of a car; and 4 a part of the end thereof. Hollow chair-stands 5, preferably of iron, of vase or other suitable form, as shown, are secured to the floor 2, of the car, in single or double rows extending from one end of the car to the other on each side of the usual central passage between the seats of the car, according to the number of seats wanted between the passage and the side of the car. When two seats or chairs are arranged side by side, the chair-rotating mechanism of both is connected by a single shaft 6, as shown in Fig. 3, and where only one chair is

placed on each side of the passage, said shaft terminates within the stand of the chair. The shaft 6, extends transversely through the hollow stand 5, and has suitable bearings in the latter, in which it has a free reciprocating rotary motion. A crank-arm 7, is secured on one end of the shaft 6, having a pin in its end, which engages in a vertical slot in the sliding-bar 8, the latter being hung on a series of roller-supports 9, on the side of the car, in which it has a reciprocating movement, which is imparted to it by the lever 10, which is pivoted on the side of the

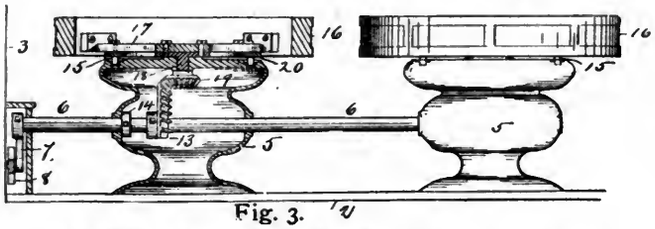


Fig. 3.

DICKINSON'S ROTARY-CHAIR FOR RAILWAY-CARRIAGES.

car and has a geared segment on its lower end which engages with and rotates a pinion 11, also pivoted on the side of the car, and said pinion engages with a rack 12, on one end of said sliding-bar. A geared segment 13, is secured on the shaft 6, within each chair-stand, as shown in Figs. 1 and 3. A collar 14, is secured on said shaft within said stand to retain the shaft in proper position. The upper end of the chair-stand is provided with a series of friction rollers 15, which sustain the weight of the chair, and on which the latter rotates. The seat-frame 16, of the chair is secured to a metal frame 17, as shown in Fig. 5, and a stud 18, is secured centrally on the latter, which projects downward through the top of the chair-stand, and on said stud is fixed a beveled pinion 19, which engages with said geared segment 13, on shaft 6. A circular bearing ring 20, is secured on the under side of the

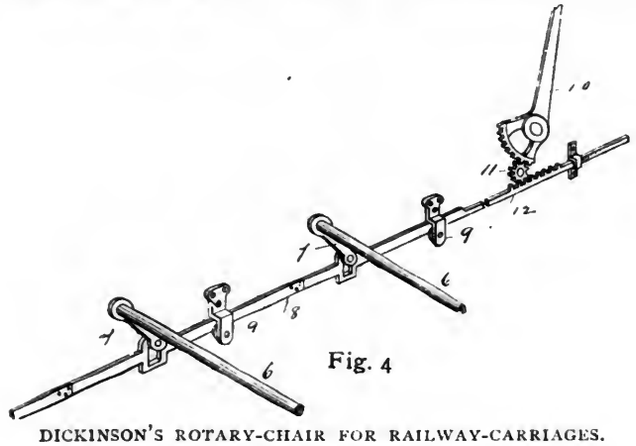


Fig. 4

DICKINSON'S ROTARY-CHAIR FOR RAILWAY-CARRIAGES.

seat-frame, over the said friction rollers on the chair-stand, forming a circular track for said rollers. The chair mounted on said seat-frame may be of the description shown in Figs. 1 and 2, or of any other desirable form which permits two thereof, when arranged side by side, to be rotated on the stands 5, as set forth.

The above-described construction of railway-car chairs and means for simultaneously rotating them to cause them to face in the direction of the movement of the car obviates the necessity of turning over car-seats one by one when the direction of the movement of the car is changed, and provides convenient means for providing one or two revolving chairs in the place of the usual long seat in a car, and for retaining said clairs in proper position.

The operation of this device is as follows: When it is desirable to reverse the chairs, the lever 10, is seized by the operator and swung on its pivot, thereby rotating the pinion 11, and the latter engaging with the rack 12, im-

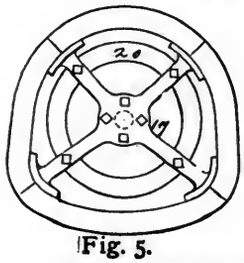


Fig. 5.

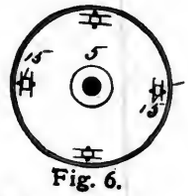


Fig. 6.

DICKINSON'S ROTARY-CHAIR FOR RAILWAY-CARRIAGES.

parts a longitudinal motion to the slotted sliding-bar 8, which rocks the shaft 6, and rotates the segment 13, thereby turning the chair on the stand 5, to bring it to the desired position.

It is claimed for this device that it is simple and durable in construction, and has the important and novel advantage of enabling all the seats in a car to be reversed and turned in the desired direction simultaneously, and by means of a single motion; while the arrangement adds greatly to the car's attractive appearance.

Flindall's Railroad-Rail Joint.

JOHN FLINDALL, of Morgan Park, Ill., is the inventor of a new and improved form of railroad-rail joint, which is herewith illustrated and described. The invention relates to railroad-rail joints; and it consists in certain peculiarities of the construction of the bolts and their fastening-nuts, as described.

In the accompanying cuts, Fig. 1 is an end view of the joint; Fig. 2 is a horizontal section of the same, and Figs. 3, 4 and 5 are detail views of the bolt, nut and wedge.

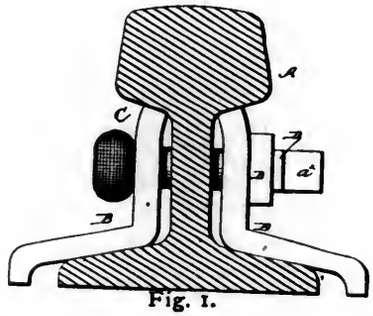


Fig. 1.

FLINDALL'S RAILROAD-RAIL JOINT.

A represents a railroad-rail of the usual form, and B B are the fish-plates on each side of the joint. Through the plates B, and the web of the rail A, are passed a series of bolts or pins C, headed on one end, as usual, but without screw-threads. The ends of these bolts are bent to one side, as at a, beyond the fish-plate, and formed with one side flattened, as at a', and the extreme point is continued in a thin web a^2, as fully shown in Fig. 3. Upon the shank of the bolt is placed a nut or plate D, having its hole d, beveled outward on each side, as clearly shown in

Figs. 2 and 4, and a wedge-key D′, is driven into this nut, as represented. When the joint is formed, the bolts C, are passed through the rails and plates B, and the nuts D, placed on their bent or angular ends, this angular portion of the bolt just fitting the bevel upon one side of the nut. The wedge D′, is then slipped into the nut against

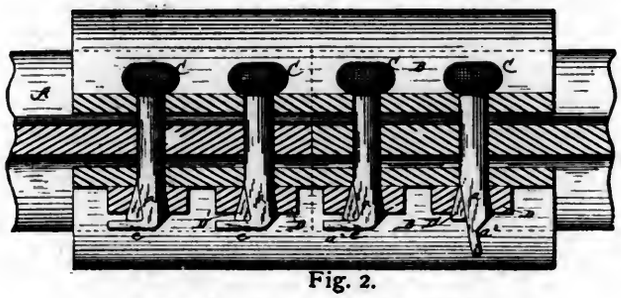


Fig. 2.

FLINDALL'S RAILROAD-RAIL JOINT.

the flattened side of the bolt, and the parts are tightened by a blow upon the wedge and head of the bolt at the same time. The thin point of the bolt is then bent down over the wedge, as at *e*, and the whole is secure against any possible loosening by the jar of passing trains or other accident. When the bolt is to be removed, the point is bent out and a side blow on the wedge then loosens the parts effectually. It is obvious that instead

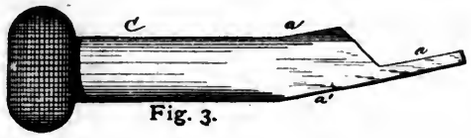


Fig. 3.

Fig. 4.

Fig. 5.

FLINDALL'S RAILROAD-RAIL JOINT.

of a nut upon each bolt, a bar may be used having beveled holes for all the bolts, exactly as described.

It is claimed for this form of rail-joint that it is simple, economical and reliable, thoroughly answering the purposes for which it is designed, and effects a large saving in smoothness of joint and close connection.

The device is controlled by the patentee, to whom all inquiries and communications should be addressed.

Moore's Car-Coupling.

WILLIAM HENRY MOORE, of Elsie, Mich., is the inventor of a new and improved form of car-coupling, which is herewith illustrated and described. The invention relates to that form of car-coupling adapted to automatic working under all conditions, combined with entire safety to those handling the device.

In the accompanying cuts, Fig. 1 is a sectional plan view of the improved car-coupling coupled; Fig. 2 is a similar view uncoupled; Fig. 3 is a cross-sectional view of the same on the line *x x*, Fig. 2.

The draw-head A, is provided in its outer end with the opening B, through which the link C, can be passed into the draw-head, and which leads into the cavity D, in the draw-head in the bottom of which cavity the recess E, is formed. In the cavity D, the coupling-hook F, is pivoted to swing vertically, the prong of the said hook being at the front end of the draw-head. The spring G, secured in the draw-head, rests on the hook F, and presses the same downward.

The shaft H, is journaled transversely in the draw-head, extends to the sides of the car, and is provided at the end with the handles I, and in the recess E, the cam J, is mounted on the said shaft, the cam being below the coupling-hook F. In the bottom of the opening B, the notch or recess L, is formed for receiving the end of the prong of the coupling-hook F.

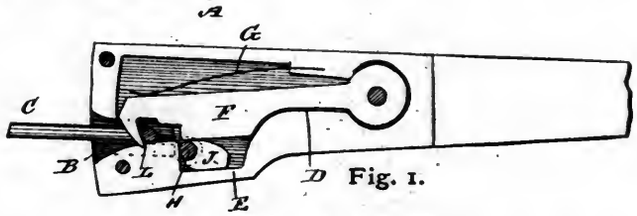


Fig. 1.

MOORE'S CAR-COUPLING.

When the cam J, is swung down, the cars can be coupled. The entering link C, strikes the beveled end of the coupling-hook F, and swings the same upward until the inner end of the said link has passed the prong of the coupling-hook, when said hook is forced down by the spring G, the prong of the hook passes through the link, and the link is thus coupled. To uncouple, the shaft H, is turned in such a manner as to swing the cam J, upward and cause it to raise the coupling-hook F. When the

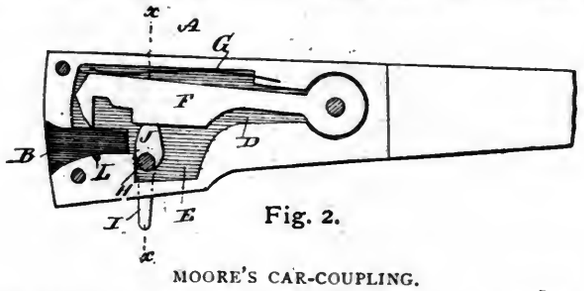


Fig. 2.

MOORE'S CAR-COUPLING.

draw-head is to be so adjusted that it cannot couple, the cam J, is swung up to hold the coupling-hook raised and prevent the spring from forcing it down. When the coupling-hook is lowered the end of its prong rests in the recess or notch L, thus preventing the link from sliding out under the prong of the hook.

It is claimed for this form of car-coupling that it is thoroughly automatic, reliable, simple and economical,

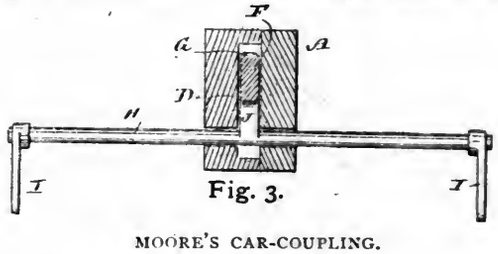


Fig. 3.

MOORE'S CAR-COUPLING.

and is readily attached to any form of car. It will work equally well on grades and curves, and is handled with great ease.

The invention is under the control of the inventor and Walter Scott Moore, also of Elsie, Mich., to whom an interest in the device has been assigned.

Holland's Road-Bed or Rail-Support for Railways.

ROBERT M. HOLLAND, of Philadelphia, Pa., is the inventor of a new and improved form of road-bed or rail-support for railways, which is herewith illustrated and described. The object of this invention is to provide suitable cushioning and supporting devices for rails of railways, dispensing with the usual sleepers, to the end that the cars traveling over such a road-bed may run more smoothly and with less jarring to the occupants of the train, and in carrying out the device the rails are connected by metallic ties, so as to insure their exact gauge, and support the said rails upon air-cushioning devices, whereby vertical elasticity is given to them.

In the accompanying cuts, Fig. 1 is a plan view of a railway embodying the improvements; Fig. 2 is a cross-section of same on line *x x*, and Fig. 3 is a cross-section on line *y y* through one of the rails and one of its supporting cushions or chairs.

A are the rails, and are coupled together to the requisite gauge by the metallic tie-bars B, which may be secured to the rails in any suitable manner, a simple construction being that shown, in which a U-shaped bolt C, is passed through holes *b*, in the bar, and the upper end *c*, bent down over the flange of the rail. These rails are

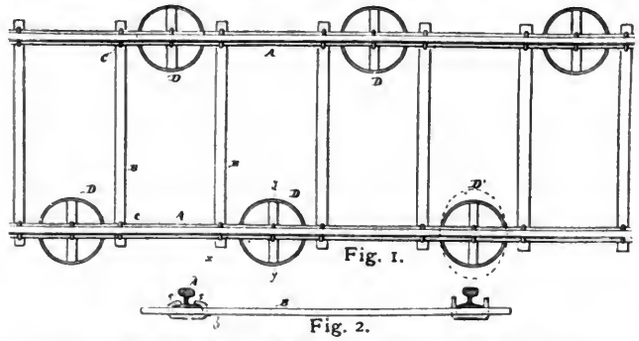


Fig. 1.

Fig. 2.

HOLLAND'S ROAD-BED OR RAIL-SUPPORT FOR RAILWAYS.

supported upon the cushioning-chairs D, which are preferably arranged between their alternate bar or ties, and under one rail are also preferably staggered with reference to those under the other rail. In construction these chairs are composed of a cylindrical casing E, having a flange or shoulder *e*, at the bottom, and into which the inverted, dished or dome-shaped diaphragm F, is placed, forming an air-space G, between it and the base H, upon which the chair rests.

I is a stirrup or rail-support, having its ends J, bent down to fit within the cylinder E, and secured therein by bolts K. To this stirrup the rail A, is secured and supported, and fastened by bolts L, similar to those C, already described, or in any other manner.

f is a sheet of felt, paper, or other similar material, placed in the bottom of the cylinder and upon the diaphragm F, as a frost-protector. The interior of the cylinder E, above the diaphragm is now filled with concrete or asphaltum M, so that the rail and its stirrup I, rests upon the floor of concrete, and the concrete is supported above a metallic diaphragm and an air-cushion beneath. The metallic portions may be galvanized, if desired, or the cylinder E, alone may be galvanized, to prevent the action of the elements upon the iron. These cylinders may be elliptical, as indicated in dotted lines D', Fig. 1, if desired, to obtain a greater area; but such changes are immaterial to the invention.

These cushioning-chairs are supported upon a level ground surface H, and the road may be ballasted with stone, which, surrounding cylinder E, retains the rails from lateral displacement and keeps them in line. If desired, holes may be dug in the ground and these chairs placed within the same, resting upon the level bottom thereof, and the weight with the cylinder E, resting upon the ground securely closes the air in the space G.

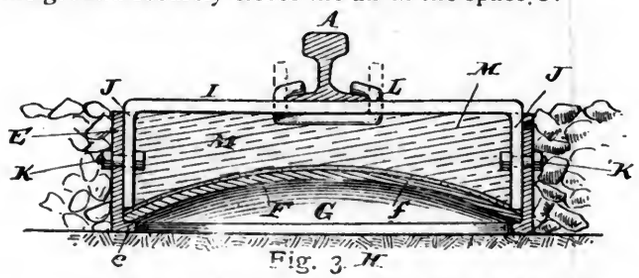


Fig. 3.

HOLLAND'S ROAD-BED OR RAIL-SUPPORT FOR RAILWAYS.

While the above described is the preferable form of construction, it need not be limited to the exact details thereof, which may be altered and modified as circumstances may require.

It is claimed for this form of construction that trains running at the highest speed will travel smoothly and without jarring, and the usual annoyance of noise and rattle be obviated; while the absence of oscillation and shaking ordinary to a train in motion, will result in a greatly increased economy to the road.

The device is under the sole control of the inventor, to whom all communications should be addressed.

Hackenberg's Oil-Cabinet.

JACOB A. HACKENBERG, of Kimberton, Pa., is the inventor of a new and improved form of oil-cabinet, which is herewith illustrated and described. This invention relates to improvements in oil-cabinets; and it consists in the combination of the cabinet, the pocket connected thereto and into which the oil from the measures is emptied, the measures, the rods for operating them, and a single faucet connected with the pocket, the top edge of the pocket having recesses formed in it, so as to correspond to the shape of the measures, and thus allow the measures to be tilted, so as to empty their contents into it. The object of the invention is to pivot the different measures below their centers between the pronged ends of the rods by means of which they are operated, so that when the measures are drawn up to the top of the cabinet they will automatically tilt and empty their contents into the pocket.

In the accompanying cuts, Figs. 1 and 2 are vertical longitudinal sections of an oil-cabinet embodying the invention.

A represents the tank, body, or cabinet in which the oil is placed for the purpose of being measured out from time to time. In order to cause the oil to settle upon that side of the bottom of the cabinet where the measures descend to be filled, there is placed in the bottom the partition B, which divides the bottom of the cabinet vertically to a greater height than the top of the largest measure,

and which partition has its top inclined downward, as shown. No oil enters that portion of the bottom which is inclosed by the partition, and hence all of the oil that remains in the cabinet after the supply has become somewhat exhausted flows down into the space C, where the measures descend to be filled. If this partition were not used, a large amount of the oil would always remain in the cabinet, and which could never be reached by any of the measures. The lid D, of this tank is hinged to the top, so that it can be raised to allow the oil to be poured into the tank, or for any other purpose; but the remaining portion of the top of the cabinet is preferably rigidly secured to the cabinet, and is curved upward, as shown, so as to allow the measures to be raised freely above the top of the pocket F, into which the measures empty their contents. The rear side of the pocket F, projects downward to the bottom of the cabinet, so as to form the vertical wall or surface R, against which the measures J, are held by the rods I, and which wall or surface serves as a guide to keep the measures in a vertical position until they

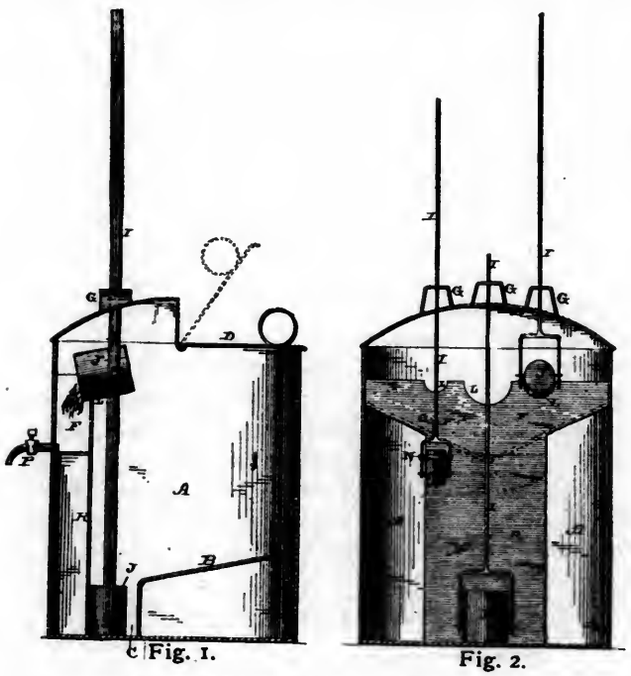


Fig. 1.

Fig. 2.

HACKENBERG'S OIL-CABINET.

reach the top of the pocket. Upon the top of the stationary portion of the cover are suitable guides G, and in these guides and the top are formed openings through which the rods I, work up and down. Each one of these rods I, has its end made forked or pronged, and in between these pronged ends are pivoted, below their centers, the measures J, of different sizes. These measures are pivoted below and back of their centers, so that when they are raised upward they will freely tip forward, and thus discharge their contents in the pocket F. Each measure is retained in a vertical position between the pronged ends of its rod by bearing against either the side of the pocket when the pocket is formed inside of the cabinet, or against the side of the can when the pocket is formed outside. As long as the measures bear against the side of the pocket or the side of the can, they can neither tilt backward nor forward; but as soon as their upper portions rise slightly beyond their corresponding recesses L, in the top of the pocket the weight of the fluid causes the measures to tilt forward, and thus empty their contents into the pocket.

If so desired, in order to prevent the measures from tilting backward, a band N, may be attached to the prongs of each rod in the rear of each measure, so that when the measure is raised above the pocket it can only tip forward and empty into the pocket and not backward. This band is not absolutely necessary, and may be used or not, as may be desired. If desired, there may be also attached to each one of the rods a stop O, which will strike against the under side of the top of the cover, and thus prevent the measure from being raised higher than is necessary to empty into the pocket. The measure F, may be placed either inside or outside of the tank, but is here shown as placed inside as a mere matter of convenience. The rear top edge of this pocket has a number of recesses formed in it, and each recess corresponds to the shape and the size of one of the measures. By means of these recesses which are formed in the top edges of the pocket the measures are enabled to begin to tip forward as soon as their upper portions begin to rise above the pocket, and thus there is no danger of their tilting backward. To the bottom of this pocket is connected a faucet P, through which the oil which is emptied into the pocket can be drawn off at will.

It is claimed for this form of oil-cabinet that it is simple, useful and durable, and fully answers all the requirements appertaining to the purpose. All inquiries and communications should be addressed to the inventor, Jacob A. Hackenberg, Kimberton, Pa.

Moorman's Car-Coupling.

JAMES F. MOORMAN, of Ohio, Iowa, is the inventor of a new and improved form of car-coupling, which is herewith illustrated and described. This invention relates to improvements in car-couplings; and the novelty consists of the peculiar construction and combination of parts, substantially as hereinafter fully set forth and illustrated,

The object of the invention is to provide a car-coupling which shall automatically couple when the draw-heads thereof abut together, and which shall be easy and thoroughly effective in operation; to provide means whereby the shock and jar occasioned by the cars coming together shall be in a great measure taken up by the draw-heads, and prevented from being communicated to the car-body; to provide means whereby the draw-heads may be readily uncoupled and disconnected, and to combine simplicity with strength and durability of construction.

In the accompanying cuts, Fig. 1 is a perspective view of a car-coupling embodying the invention, showing the draw-heads thereof coupled together; Fig. 2 is a detail perspective view of one of the draw-heads, and Fig. 3 is a horizontal longitudinal section of one of the draw-heads on the line $x\ x$ of Fig. 2.

A B, designate the draw-heads to be secured to the meeting ends of two railway-cars beneath and at the middle of the same and projecting beyond one end thereof. Each draw-head is cut away at its front end so as to provide a socket E, and two forwardly-projecting arms C D, which arms are arranged a distance apart at their rear

ends equal to the width, or a little more so, of the extreme outer end of the arm C, and thus forms the socket E, and the arm C, of one draw-head fits in the socket of the fellow draw-head. The arms C D, of each draw-head are arranged at opposite sides thereof, and the arm C, is of a greater length than the arm D, for the purpose above described. The inner vertical face of the arm C, has an inclined abutment *c*, and the similar face of the arm D, is rounded or curved, as shown at *d*, the inclined and rounded faces of the arms serving to guide the arms C, of the adjacent or fellow draw-head into the socket E, to connect said draw-heads together. The coupling-arms C, of each draw-head are chambered out, as at *e*, in Fig. 3, and the inner vertical faces of the arms are slotted, as at *e'*, which opens into the chamber *e*.

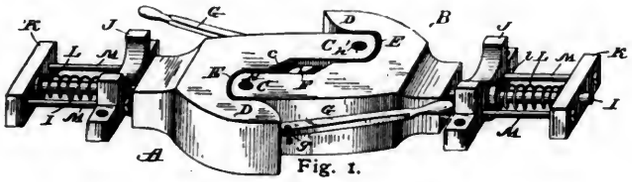


Fig. 1.

MOORMAN'S CAR-COUPLING.

F designates the coupling-hooks, arranged in the chamber *e*, and pivoted therein at its rear end, as at *f*, and having its hook-shaped end *f'*, normally pressed or forced outwardly through the slot *e'*, by means of a spring F', also arranged in the chamber *e*, as shown in Fig. 3. The front vertical faces of the hook-shaped ends of the coupling-hooks *f'*, are rounded or beveled, and when the draw-heads come or abut together for coupling, the beveled or rounded faces of the coupling-hooks thereof impinge against each other, to force said hooks rearwardly against the tension of the pressure-springs to effect the engagement of the coupling-hooks, and consequently coupling

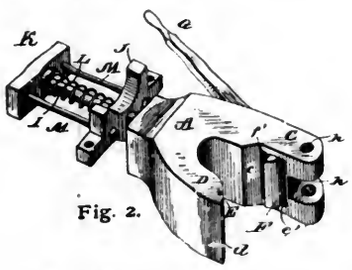


Fig. 2.

MOORMAN'S CAR COUPLING.

the cars together. The inclined and rounded faces of the arms of each draw-head serve as guides to the arm C, in entering the socket E, thereof, and the arms D, prevent lateral play of the draw-heads when the cars are in motion, so as to prevent them from becoming uncoupled. The cars are automatically coupled and the necessary play of the draw-heads permitted in rounding curves or other portions of the track which are out of a straight line.

G designates levers for uncoupling the cars, the said levers being secured to a pin or bolt *g*, which passes through the draw-head and is secured to the coupling-hook F. The front vertical face of the arm C, may be recessed, as at *h*, for the reception of a coupling-link when it is desired or becomes necessary to use a pin-and-link coupling, said arm C, being further provided with vertical perforations or passages *h'*, for the reception of the coupling-pin to engage the link fitted in the recess *h*. The rear end of each draw-head is provided with a guide-bar or rod I, which is rigidly secured thereto and passes through an opening in a bracket or supporting-casting J, which is securely bolted or otherwise rigidly fastened to the car-body or platform.

K designates a sliding plate arranged to move on the bar or rod I, longitudinally thereof at its rear end, and this plate is normally pressed or forced rearwardly against

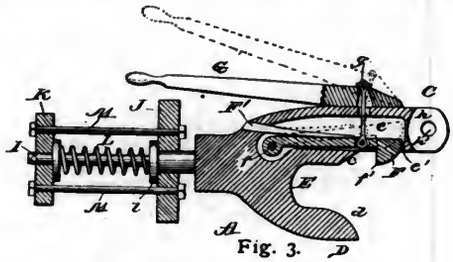


Fig. 3.

MOORMAN'S CAR-COUPLING.

a stop lug, pin, or plate on the rear end of said guide-bar by means of a coiled or other suitable spring L, arranged and supported on the guide-bar. The front end of the spring is secured to the bar I, and bears against a plate or washer *l*, and the sliding-plate K, is perforated at its side edges, and through these perforations headed guide-pins or rods M, pass, which guides are secured in the supporting casting or bracket J. It will be seen that when the draw-heads come together they will be forced rearwardly, and consequently carry with them the bars I, and the springs L, which movement serves to compress the springs and cause the plate K, to move or slide upon the bar and the headed guide-pins. The force or shock occasioned by the draw-heads abutting together is thus taken up by the same, and prevented from being communicated to the car-body and platform in a great measure.

It is claimed for this form of car-coupling that it is simple, durable and economical, and will couple at different elevations, and on grades and curves.

Shobe's Cable Railway.

ABRAHAM A. SHOBE, of Jerseyville, Ill., is the inventor of a new form of cable railway, the construction and operation of which is herewith illustrated and described. The invention relates to an improvement in cable railways, and it consists, essentially, in providing for the cable a

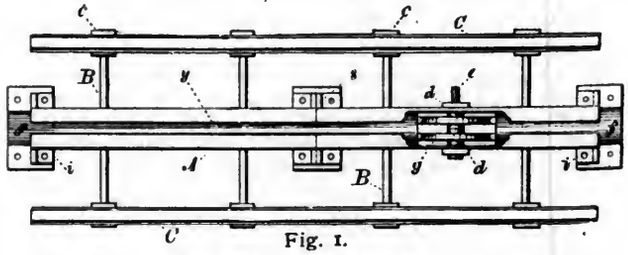


Fig. 1.

SHOBE'S CABLE RAILWAY.

tube or tunnel which may be employed either with an ordinary double-rail track, or with a triple-rail track, of which the central rail is adapted to carry the main weight of the cars, the tube or tunnel being so constructed that it may be used for either of the above-named types of

railway without requiring any alteration in the form or dimensions of the several parts of which it is composed; and, further, that it shall constitute the main support for the cross-ties, to the extremities of which are secured the chairs upon which rest the two outer rails, so as to secure the whole rigidly together in one structure sustained mainly upon columns or supports located at suitable intervals centrally throughout the entire length of the road-bed.

In the accompanying cuts, Fig. 1 is a plan view of the device without the central rail; Fig. 2 a side elevational view of the same; Fig. 3 a transverse sectional view taken in the line *x x* in Fig. 2, showing one of the cross-ties, to

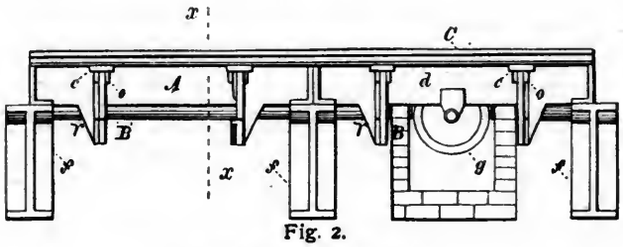


Fig. 2.

SHOBE'S CABLE RAILWAY.

the extremities of which are secured chairs surmounted by the rails; and Fig. 4 a transverse sectional view of the cable-tube shown in connection with the central rail, and also taken in the line *x x* in Fig. 2, and Fig. 5 a perspective view of the rails, cable-tube and drain-pipe.

A represents a cable tube or tunnel divided longitudinally into two separate and strictly similar parts, entirely distinct from each other (fully shown in the plan view in Fig. 1,) and provided with flanges *i*, by which the tube is secured to the tops of central supports *f*, designed to reach below the surface of the road-bed sufficiently far to secure a permanently solid foundation. The sections of the tube are secured together, end to end, preferably by flanges S, adapted to receive bolts or rivets. To the under side of each half of the tube are secured knee-plates

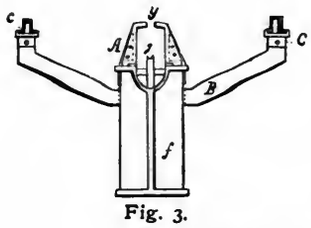


Fig. 3.

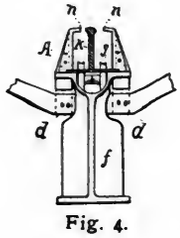


Fig. 4.

SHOBE'S CABLE RAILWAY.

r, (shown in Fig. 2,) to which are bolted cross-ties B, the outer ends of which are bent into a vertical position, so as to support at a proper elevation chairs *c*, each of which is provided with a downward-projecting flange *o*, by which it is secured to the cross-tie. The tops of the chairs are preferably made flat, as shown, and are intended to rest on the surface of the road-bed, the upper surface being designed to receive any ordinary form of rail secured in position by any of the means usually employed for that purpose.

At suitable distances apart throughout the length of the tube are cable-carriers *g*, adapted to revolve upon fixed spindles *e*, supported by hangers *d*, secured to the sides of the tube, as shown in Fig. 2. To adapt the tube for the reception of a deep central rail *k*, secured to the central supports *f*, by bolts, rivets, or other suitable fastenings, the two halves are removed laterally upon the central supports to such position that they stand at such a distance apart as the base of the rail may require for its admission between them, or as may be necessary to leave an opening *n*, shown in Fig. 4, between each side of the head of the rail and the tube, to admit the arm of an ordinary cable-grip, which, when the center rail is not employed, passes down into the tube through the opening *y*, as shown in Figs. 1 and 3.

It will be observed that each central support is provided with a semicircular cavity in the top, for the reception of similarly formed gutters, the office of which is, to convey the water, which in rainy seasons flows into the cable-tube, into the pits provided for the cable-carriers, as shown at B in Fig. 2, whence it may be conducted by drain-pipes to wherever most conveniently disposed of. In order to adapt the spindles *e*, upon which the cable-

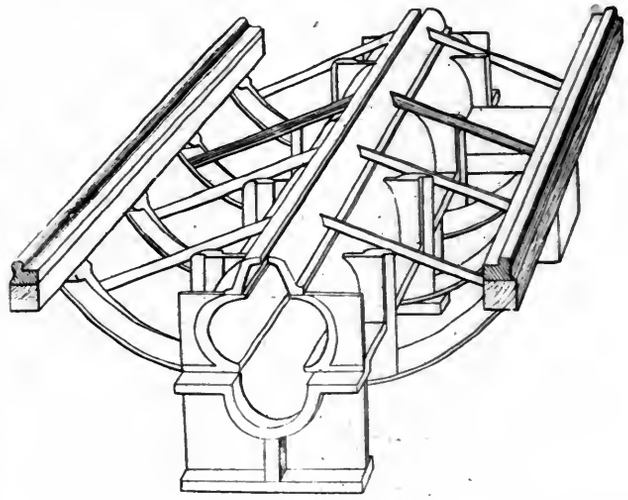


Fig 5.

SHOBE'S CABLE RAILWAY.

carriers revolve, to the triple as well as to the double rail track, they are made long enough to reach through both hangers when the two halves of the tube are separated to the widest extent, one end being rigidly secured in the eye of one hanger, and the other free to slide longitudinally through the eye of the opposite one, as shown in Fig. 1.

In regard to the cross-ties, it will be observed that they are each provided, as shown at *h* in Fig. 3, with bolt-holes adapted to both positions of the two halves of the tube, the two inner holes to be used when the two halves of the tube are in the position shown in Fig. 3, and the two outer ones when in the position shown in Fig. 4. For the operation of branch roads a third, or, if necessary, a fourth, cable-carrier may be interposed between the two as shown in the cuts.

It is claimed by the inventor that this form of cable railway effects all desirable ends, and the material being wholly metal is, if properly prepared, practically indestructible; extensive excavation is not required, and the absence of bolts, spikes, etc., renders its construction simple and economical.

Harrison's Platform-Gate for Railway-Cars.

JAMES P. HARRISON, of Danville, Va., is the inventor of a new and improved form of platform-gate, the construction and operation of which is herewith illustrated and described. The object of the invention is to provide means whereby the exit and entry openings of railway and other cars may be controlled throughout a train by the engineer or other selected train-hand, so that no danger can arise by passengers being tempted to leave or board a moving train, the entrances to the cars being closed throughout the train at the moment of starting, and consists in a system or series of movable or swinging gates attached to the exit and entry openings of railway and other cars in combination with connecting devices throughout the train whereby the gates to the cars of the entire train will be simultaneously closed or opened from one specified point by one train-hand, preferably the engineer.

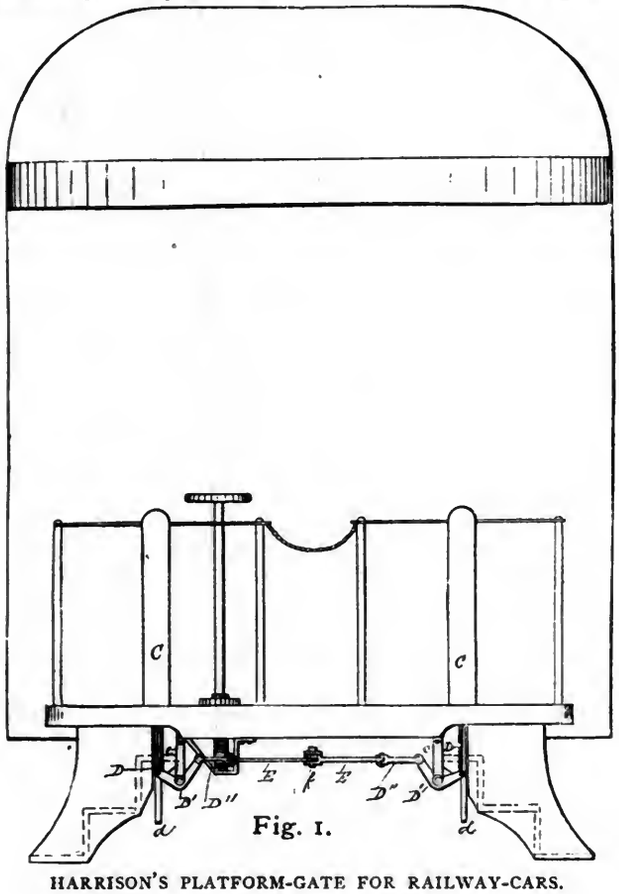
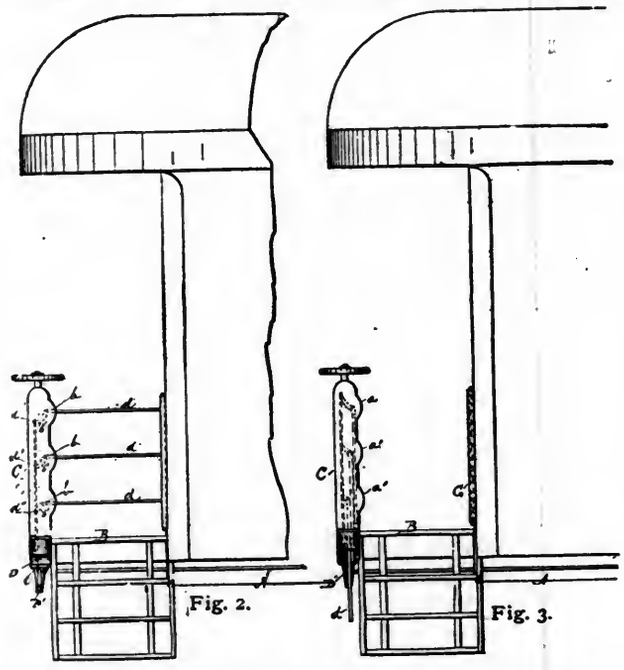


Fig. 1.

HARRISON'S PLATFORM-GATE FOR RAILWAY-CARS.

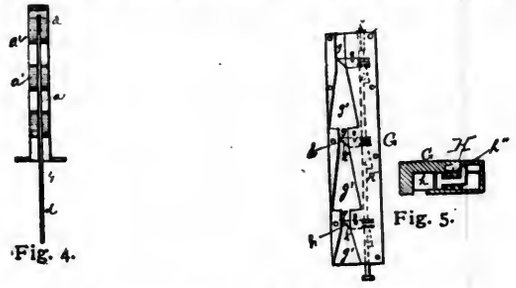
In the accompanying cuts, Fig. 1 is a view of an end of a car with the invention attached; Fig. 2 is a side elevation of the end of a car, showing the platform-gate closed; Fig. 3 is a side elevation of the end of a car, showing the platform-gate opened; Fig. 4 is a front elevation of the hollow post and gate-bars closed down; Fig. 5 is a front elevation of the sustaining and locking-bar to secure the free end of the gate-bars and a section thereof on line *y y*, and Fig. 6 a bottom plan view of the car and devices for operating the gate-bars and locks, the brakes being on and the gates open.

A is the bed or frame of the car, and B the platform. From the outer edge of the platform on each side there is removed one of the ordinary stanchions used to support the hand-rail, and in their places are set or bolted to the platform hollow posts C, provided with a slot *a*, on the side next to the car-body and slotted lumps or projections *a'*, forming bearings for pivots *b*, on which swing vertically-moving bars *d' d'*, which constitute the gate proper. Integral with the bars *d*, and projecting beyond the pivots *b*, are short crank-levers *b'*, to the rear ends of which, at *d d' d''*, is pivoted a vertical pull-bar D, the lower end of which is pivoted to one arm of a bell-crank D', swung in a hanger *e*, secured beneath the platform. The inner



HARRISON'S PLATFORM-GATE FOR RAILWAY-CARS.

ends of the inner arms of bell-crank levers D', are pivoted to sliding bars D'', moving in eyes or hangers beneath the platform, and in turn these bars D'', are pivoted to the arms E E, of a toggle-lever, having a central pivot *f*, to which is secured an operating bar or rod F, passing to the piston-rod of the air-cylinder of the automatic brake, in this instance, for illustration, the Eames air-brake. The rod F, is moved back and forth by the air-cylinder piston, and this, obviously, through the toggle-lever, bars D'', bell-crank levers D', and pull-bar D, raises and lowers the



HARRISON'S PLATFORM-GATE FOR RAILWAY-CARS.

bars *d*, so as to alternately close and open the entrances to the platform, as shown in Figs. 2 and 3. When the bars *d*, are raised across the platform, it is necessary to secure their free ends and give stability to the gate while the brakes are off. This is accomplished by means of a slotted casting G, secured to the exterior of the wall of the car in line opposite the movement of the bars *d*. For fear that the free ends of the bars may be deflected from entering the holding-slot *g*, sections of the slot *g'*, are flared, as

shown, so as to guide the end of the bar into slot *g*, as the arc of the movement of the free end of the bar approaches termination. The ends of the bars then pass over spring-bolts *h*, having beveled faces *h'*, and lugs *h''*, behind which moves an unlocking-bar H, which slides in ways in casting G, and is provided with a series of wedged-shaped sections *i i*, lying behind lugs *h''*, so that an upward movement of the bar H, will cause the bolts to recede and liberate the ends of bars *d*. The unlocking-bar is caused to move upward by means of a wire rope or cord *i'*, which passes over a sheave *j*, and down over another sheave *j'*, to the lever attached to the air-cylinder piston-rod. In the lengths of the wires or cords *i'*, at some point are interposed springs *k*, to give the operation of the cords a yielding or elastic movement.

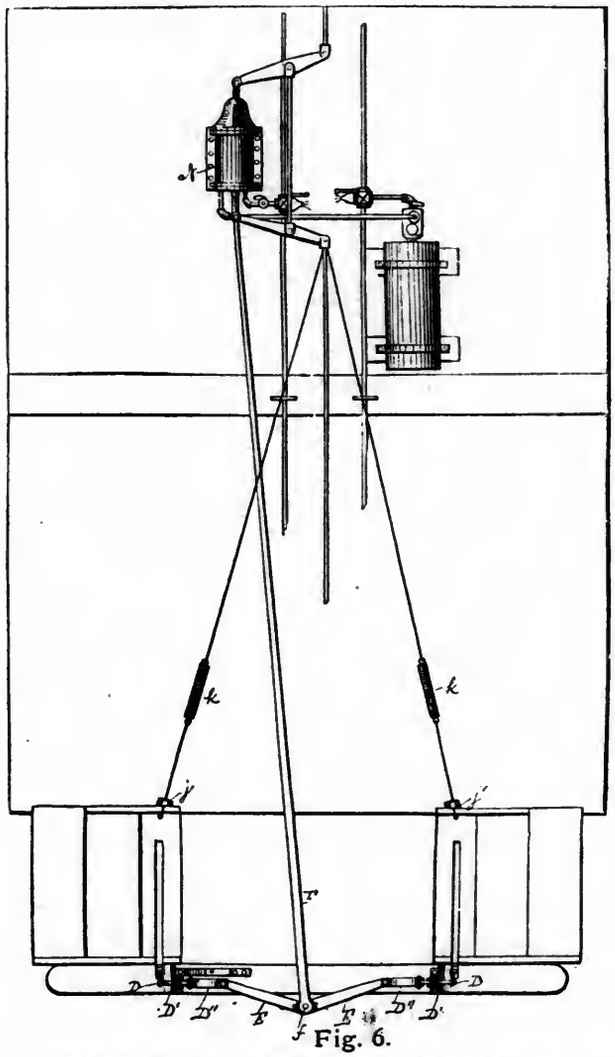


Fig. 6.

HARRISON'S PLATFORM-GATE FOR RAILWAY-CARS.

Among the merits claimed for the device is that when in motion the train is freely open for passage from end to end, as the application of the gate renders falling from the platform impossible, while it also is impossible for trespassers to board the cars except under the eye of the crew. The conductor and brakemen are provided with keys which enable them to unlock a special gate, as may be required.

The device is specially adapted to most southern roads where access to trains is generally free to all, and would be an effectual prevention of the many accidents resulting from the frequent attempts to board or leave moving trains.

Davis's Electric-Alarm Clock.

GEORGE H. DAVIS, of Washington, D. C., is the inventor of a new and improved form of electric-alarm clock, the construction and operation of which is herewith illustrated and described. This invention relates to that class of alarm-clocks that actuate electric signals at predetermined times, and has for its objects to provide easy adjustment of the contacts by means of which the circuit is completed and the signal operated; to provid emeans for regulating the length of circuit-contact; to provide means whereby the signal can be operated at predetermined unequal intervals, or at intervals of greater length than twelve hours, and to provide a simple and inexpensive construction for accomplishing the objects herein set forth.

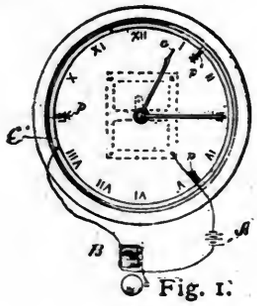


Fig. 1.

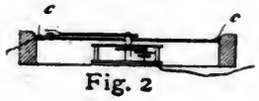


Fig. 2

DAVIS'S ELECTRIC-ALARM CLOCK.

In the accompanying cuts, Fig. 1 is a view of a clock-dial provided with the improvements; Fig. 2 is a section of the same showing the adjustment of the clock-pointers with reference to the improvements; Fig. 3 is one form of the improved contact-wheel to be used upon clocks with large dials; Figs. 4 and 7 are other forms of the same to be used upon clocks with small dials in connection with the improved rim attachments; Fig. 5 is a detached view of the contact-wheel provided with alternate conducting and non-conducting blades. Fig. 6 is a detail view showing the circuit-breaker in position with contact-wheel, and Fig. 8 shows one of various forms which has for its object the completion of the circuit without passing it through the hands and works. In this form the pivot-

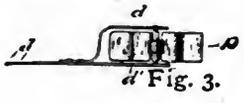


Fig. 3.

Fig. 4.

DAVIS'S ELECTRIC-ALARM CLOCK.

needle, in passing over an insulated plane, comes in momentary contact with a conducting surface, thus completing the circuit between this point and the frame.

Emanating from the battery A, are two conductors, one of which is connected with the frame-work of the clock mechanism or "works," the other, after passing through the electro-magnets B, to the rim C, upon the clock-face. Under this rim C, is inserted a sharpened end *d'*, of the frame of the contact-wheel D, being held firmly in position by the pressure of the rim upon the dial. The contact-wheel, as shown in Fig. 3, is pivoted upon its axis between sockets formed in the frame *d'*, and the spring d^2, which latter presses upon and regulates its movement. The contact-wheel, as shown in Fig. 4, is pivoted on its axis between sockets in the rim E, and the spring F. The

rim E, is fastened to the dial by small screws, the outer edge being flared, as shown in the cuts, and provided with small depressions for the reception of wheel D. Rim E. is only used where the clock is not provided with a conducting-rim, as C, and is of the shape shown in Fig. 4. The spring F, is formed so as to extend under the flared portion of the rim E, and over the pivot of the wheel D, forming a small socket for the same, the pressure or strain of said spring on the under side of flared part of the rim and pivot of wheel D, retaining it in position. The contact-wheel D, is provided with six blades. each alternate one being composed of conducting material and the remainder of non-conducting material. This may be altered at will. It may be desired to have an alarm only once in thirty-six hours, in which case there would

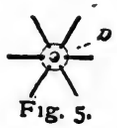


Fig. 5.

Fig. 6.

DAVIS'S ELECTRIC-ALARM CLOCK.

be two non-conducting blades between the conducting blades, as will be hereinafter more fully explained. The contact-wheels D, are placed in the path of the hour-pointer only, the minute-pointer passing over them, as shown in Fig. 2, in this way getting one contact only in twelve hours. So if an alarm were desired every thirty-six hours only, two non-conducting blades would be placed between conducting-blades, the hour-pointer making thus three revo utions of the dial between alarms. On the end of the hour-pointer is a small insulator-cap G, of the form shown in the cuts, the attachment being adjusted in proper position by the flexible side-clamps, which extend under and around the hand. The dial of the clock is insulated from the mechanism or works. A circuit is completed when the hour-pointer comes in contact with a conducting-blade of the wheel D, the hour-pointer being connec ed with the mechanism,

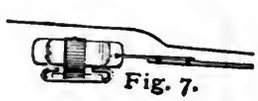


Fig. 7.

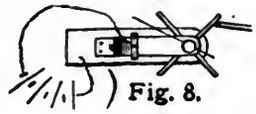


Fig. 8.

DAVIS'S ELECTRIC-ALARM CLOCK.

and the wheel D, with the rim. The circuit being closed the alarm is operated until the circuit is broken by the insulator-cap G, coming in contact with the blade. In passing this blade it will be observed that the pointer has placed one of the non-conducting blades in its path. When the pointer again reaches the wheel D, it will come in con act with and move in passing the non-conducting blades the same as it did the conducting-blades, placing in position another blade, conductor, or non-conductor, as the case may be. So on, each revolution of the pointer passing one of the blades of the wheel D, and placing another in position in its path. The contact-wheels D, may be placed at will around the rim C, using one or more, and any form of wheels, as desired, so that one day the alarm may be operated at one hour and another day at a different hour, if so desired. When it is desired not to use the alarm, the wheels D, are removed,

It is claimed for this form of alarm-clock that it is thoroughly effective in its purpose, and while complete in all its parts, is simple and economical of construction, and is not liable to become disordered.

Carll's Balanced Rocker-Valve.

ADDISON B. CARLL, of Bradford, Penn., is the inventor of a new and improved form of balanced rocker-valve, which is herewith illustrated and described.

This invention relates to an improvement in balanced oscillating valves for steam-engines; and it consists in the peculiar construction and combination of devices that will be more fully set forth hereinafter, and particularly pointed out.

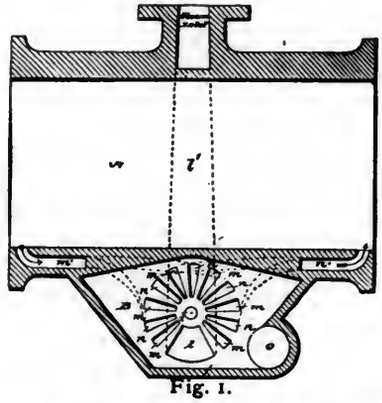


Fig. 1.

CARLL'S BALANCED ROCKER-VALVE.

In the accompanying cuts, Fig. 1 is a longitudinal sectional view of a portion of a steam-cylinder and a steam-chest with the improved valve removed; Fig. 2 is a vertical transverse sectional view of the same with the valve in position; Fig. 3 is an end elevation of the valve, and Fig. 4 is a side elevation of the same, partly in section.

A represents a steam-cylinder, and B represents the steam-chest on the under side of the cylinder. C repre-

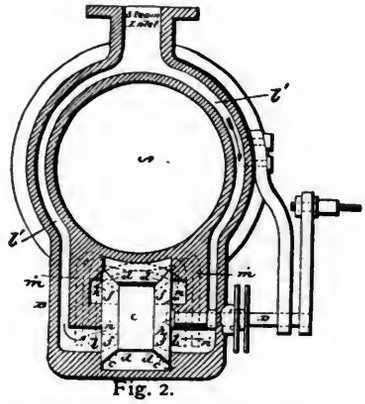


Fig. 2.

CARLL'S BALANCED ROCKER-VALVE.

sents a hollow cylindrical valve, which is formed of two sections *c c'*, fitted together and extensible telescopically, one of the said sections having inwardly projecting pins *a*, that enter and work in grooves or slots *b*, made in the other section. The ends of the valve are flanged, as at *d*, and beveled on their inner sides. The ends of the valve have the inlet-openings *e*, and the radial openings *f*, that communicate with the interior of the valve, and radial

notches *g*, are cut through the flanges on the ends of the valve between the openings *f*.

The valve is journaled in the steam-chest by means of trunnions *h*, on the ends of the valve, and recesses *i*, in the side walls of the steam-chest to receive them. The side walls of the steam chest also have ports *l*, that correspond with the openings *e*, of the valve, and the series of alternately-arranged radial ports *m* and *n*. The ports *m*, communicate with a channel *m'*, that leads to one end of the cylinder and the ports *n*, communicate with a channel *n'*, that leads to the other end of the cylinder. The ports *l*, communicate with channel *l'*, in the sides of the cylinder through which steam is admitted, and the steam-chest has an exhaust-port, one or more, *o*.

A valve-stem D, is socketed at one end to one of the trunnions of the valve, and has a crank at its outer end, which is attached by a rod to an ordinary eccentric, with which the engine is provided, in the usual manner It will thus be seen that the ends of the valve bear against the side walls of the steam-chest and are balanced therein by the pressure of the steam in the valve, which reduces friction thereon. The pressure of the steam on the inside of the valve keeps the ends of the valve tightly pressed against the side walls of the steam-chest. The valve is oscillated slightly when the engine is in motion. When the openings *f*, in the valves register with the

Fig. 3.

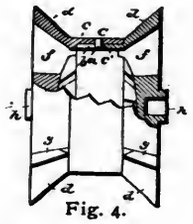


Fig. 4.

CARLL'S BALANCED ROCKER-VALVE.

openings *m*, in the steam-chest, steam is admitted to one end of the cylinder, and the notches *g*, in the flanges of the valve register with the openings *n*, so as to exhaust the steam from the opposite end of the cylinder. When the valve is turned to cause the openings *f*, to register with the openings *n*, steam is admitted to the cylinder through the channels *n'*, and exhausted from the opposite end thereof, as will be very readily understood.

By this construction of the valve it is only necessary to oscillate the latter very slightly, thus reducing wear on the valve and valve-seat to a minimum, and effecting an economy in repairs for the engine by lengthening the life of the valve. In constructing this form of valve there should be one more of the ports, marked *n*, in Fig. 1, as the port *e*, of the valve is to cover the port *l*, and one of the ports *m* or *n*, according to which end of the cylinder is taking steam. It would also be preferable in place of the short trunnions *h*, in Fig. 4, to have the valve-stem run clear through the valve, and rest in a recess in the left wall of the valve-chest.

It is claimed for this device that, being a rocker-valve, it would be best placed underneath the cylinder, consequently avoiding accumulations of water, and, being balanced, it works with great ease and little friction. It is simple, durable and effective, giving a very true motion, and can be economically constructed.

Loehner's Railway-Track Drill.

AUGUST LOEHNER, of St. Louis, Mo., is the inventor of a new form of railway-track drill, which is herewith illustrated and described. This invention relates to railway-track drills; and it consists in certain improvements in the construction of the same, as hereinafter described.

In the accompanying cuts, Fig. 1 represents a plan view of a track-drill provided with the improvement; Fig. 2 is a side view of the same, and Fig. 3 is a view of the drill-holding device detached.

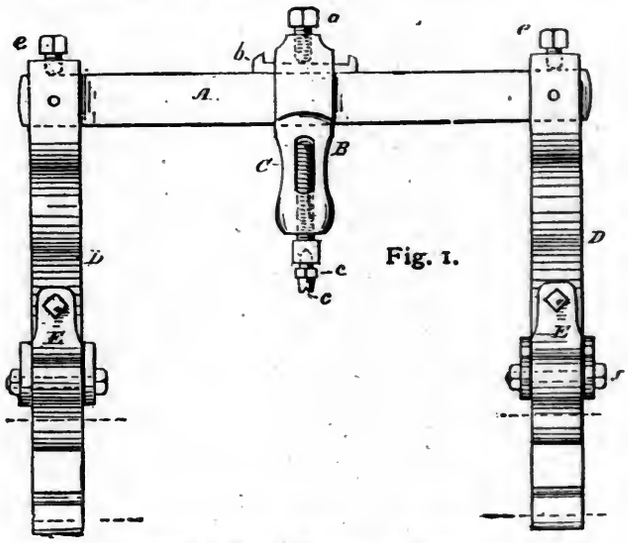


Fig. 1.

LOEHNER'S RAILWAY-TRACK DRILL.

A designates the top-bar, on which is placed the screw-housing B, which may be moved along the bar in either direction, and may be set opposite to any point where a hole is to be drilled in the track-rail, to which the device is applied and secured. The housing B, is secured fast to the bar by means of a screw *a*, which bears against a key *b*, which slides along the bar with the housing and prevents the screw from indenting the bar, so the latter is kept smooth. A screw C, is placed within and carried by the housing, the head of the screw being downward, and

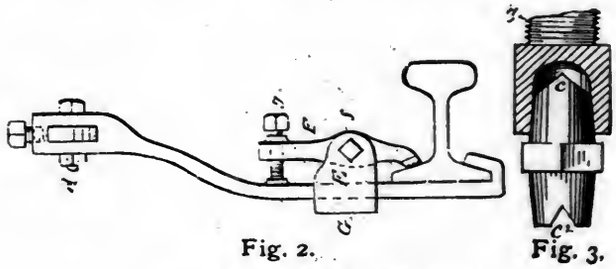


Fig. 2.

Fig. 3.

LOEHNER'S RAILWAY-TRACK DRILL.

having a socket in which is placed a double cone *c*, one having an angular point *c'*, and the other an angular notch or recess c^2, so that it may connect with any drill, either pointed or grooved.

D ind cates the hook-arms to connect with the rail to be bored, the said arms being secured to bar A, by means of bolts *d*. The screws *e*, are for the purpose of securing the arms D, to bar A, at any points desired, it being necessary sometimes to bring the arms near each other, as when drilling a hole near the end of one rail when no rail has been laid adjoining it.

E designates a clamping device, one being placed on each hook-arm to secure it firmly to the rail, said clamp being in the form of a lever or pivoted dog F, and a seat G, to which it is held by bolt *f*. A screw *g*, passes through the lever F, and being driven against arm D, closes the toothed dog tightly against the base of the rail and holds the frame firmly thereto.

It is claimed for this form of track-drill that it is simple, durable and economical, and perfectly adapted to effect the purpose of its invention.

Chappell's Car-Coupling.

CLIFTON T. CHAPPELL, of Macon, Ga., is the inventor of a new and improved form of car-coupling, which is herewith illustrated and described. The invention relates to certain improvements in that class of car-couplings by which the cars to which the couplings are attached may be automatically coupled when the cars come together,

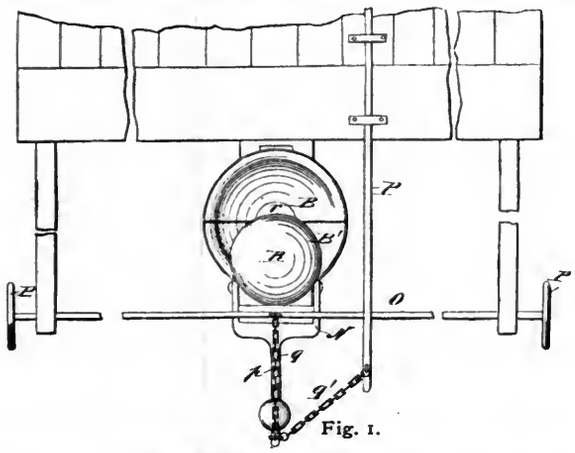


Fig. 1.

CHAPPELL'S CAR-COUPLING.

the coupling being so arranged that the cars may be uncoupled without entering the space between them, and its object is to simplify the construction of the coupling-pieces, and at the same time to render them efficient in operation; and to this end the invention consists of a pair of coupling-jaws pivotally connected to a draw-head, said jaws being formed so that when held together there is a spherical recess back of a bell-shaped mouth-piece, the jaws being held together by a locking-dog, which is retracted at the time of coupling or uncoupling, but which after the cars are coupled is held between the heels of the coupling-pieces by a spiral-spring.

In the accompanying cuts, Fig. 1 is a view of a portion of one end of an ordinary form of freight or box-car with the improved coupling applied thereto; Fig. 2 is a view of the side of the draw-head and coupling removed from the car; Fig. 3 is a view in vertical cross-section taken on line *x x* of Fig 2; Fig. 4 is a view of the connecting-link between the locking-dog and the operating-lever; Fig. 5 is a longitudinal vertical sectional view of two of the couplings, the parts being represented in the positions they assume as the cars are approaching, and the ball of the coupling-link has just struck upon the jaw of the coupling; and Fig. 6 is a similar view representing the parts as they appear after the cars have approached still closer.

A represents the draw-bar, formed with an enlarged head A′, in which there is a recess *a*, said recess being rectangular at its inner end, but being formed with beveled sides as it approaches the mouth of the head. Within

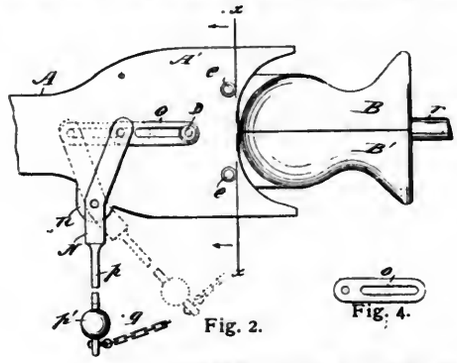


Fig. 2.

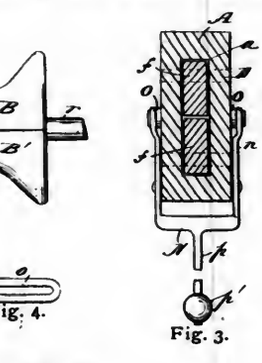


Fig. 4.

Fig. 3.

CHAPPELL'S CAR-COUPLING.

this recess *a*, there are pivotally mounted two coupling-jaws B and B′, each jaw being formed with a hemispherical recess *b*, and a flaring mouth-piece in the shape of one-half of an ordinary form of bell, there being a shoulder *c*, between the parts, as clearly shown in Figs. 5 and 6.

Back of the hemispherical portion of the coupling-jaws each jaw is provided with a lug or heel *f*, which fits within the rectangular portion of the recess *a*, the jaws being held in place by pivot-pins or bolts *e e*, and each heel *f*, being formed with a notch, so that when the two jaws are in the position shown on the left in Figs. 5 and 6 there will be a space or recess *i*, between the heels, which may be entered by a locking-dog C.

In order that the jaws may be free to swing upon their pivoted connection with the draw-head to the position shown on the right in Fig. 6, each heel *f*, is beveled off at *g*, and in order that the locking-dog may not strike

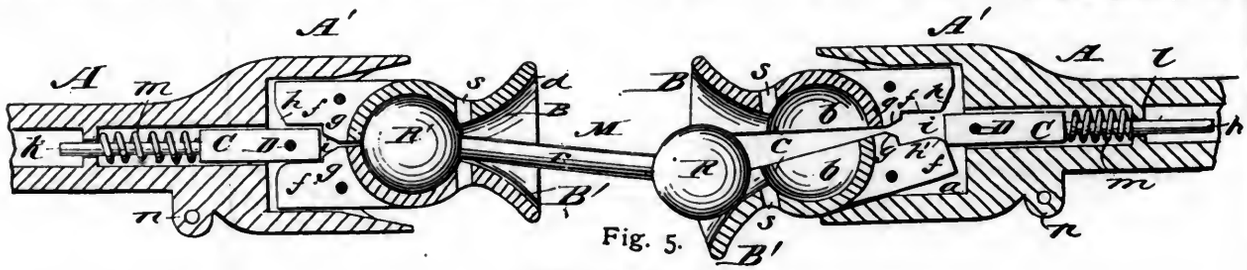


Fig. 5.

CHAPPELL'S CAR-COUPLING.

against a sharp projection or shoulder when being forced forward into the recess between the heels, the heel of the jaw B, is beveled, as shown at *h*, while the heel of the jaw B′, is rounded off at *h′*, this construction being clearly shown in the figures last referred to.

The locking-dog C, is provided with a shank *k*, which runs through an aperture formed in a partition *l*, of the draw-bar A, the dog being held forward and within the recess *i*, by means of the spiral spring *m*. In order that

the locking-dog may be withdrawn from its normal position in the socket *i*, such mechanism is provided as is best illustrated in the first four figures of the cuts. The dog C, is provided with a cross-bar D, which extends through slots formed through each side of the draw-head. Just at the point where the draw-head A′, branches out from the draw-bar A, there is a lug *n*, and to this lug there is pivoted a U-shaped lever N, which projects forward from its pivotal connection with the lug *n*, and is connected to each end of the bar D, by links *o*. From the center of the U-shaped portion of the lever N, there extends an arm *p*, which is provided with a weight *p′*, and the lower end of this arm *p*, is connected by a chain *q*, to a shaft O, which extends across the end of the car, each end of the shaft being provided with a hand-wheel, as P. A second chain *q′*, extends from the end of the arm *p*, to the lower end of a vertical shaft P′, which is secured in bearings fixed to the end of the car and extends upward slightly above the car-roof.

to the position shown in dotted lines in Fig 2, thus withdrawing the dog C, from the recess *i*, and leaving the jaws B B′, free to swing upon their pivoted connections *e*. In order that cars provided with this coupling may be coupled with cars provided with the old form of pin-and-link coupling, each of the jaws B B′, is provided with an aperture, as *s*, through which the coupling-pin may be inserted, a coupling-link of the ordinary construction being used at this time.

The balls R R′, will have all necessary play within the recesses of the locking-jaws, owing to the form of the mouth-pieces *d*.

It is claimed for this form of car-coupling that it is simple, economical, and thoroughly reliable; while it can be equally well used in conjunction with other patents or ordinary couplings as with cars fitted similarly.

The device is under the control of the inventor, to whom all communications should be addressed.

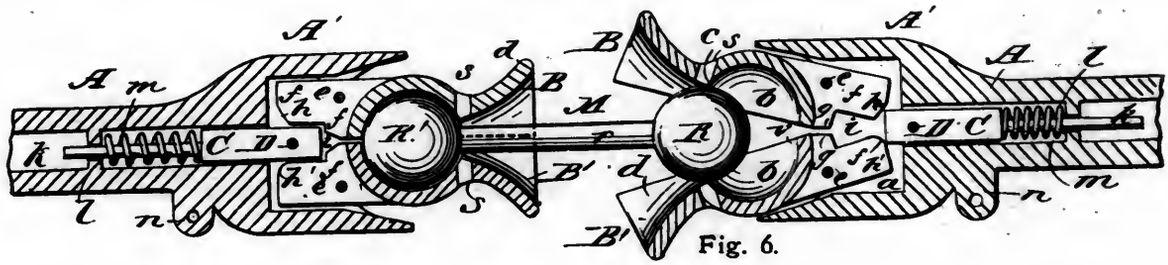


Fig. 6.

CHAPPELL'S CAR-COUPLING.

The coupling-link M, used with such a coupling as has been described, consists of a shank *r*, upon each end of which there is a ball R, so proportioned as to fit snugly within the spherical recess formed by the recesses *b b*.

The operation of this coupling is as follows: The coupling-link M, having been inserted between the jaws B B′, of one of the cars to be coupled, and the locking-dog C, having been advanced within the recess *i*, so as to prevent the jaws from swinging upon their pivotal connection, the cars to be coupled are brought together, and as they approach the extending ball R, of the coupling-link M, will strike against the bell-shaped mouth *d*, of the lower jaw B′, of the car, to which the first car named is to be coupled, because, as will be well understood, the force of gravity will draw the coupling-link M, to substantially the position shown in Fig. 5. As the cars continue to approach the ball R, will slide up the bell-shaped mouthpiece until the coupling-link and the opening jaws will be about in the position shown in Fig. 6, when anv continued approach to the cars will cause the ball to enter the recesses *b b*, after which the jaw B, will drop down so that its lower edge will be about in a horizontal plane, and the lower jaw B′, will be raised when the ball R, strikes against its inner rear face . When the parts are in this position, the spring *m*, will act to force the locking-dog C, forward within the recess *i*, thereby locking the jaws and preventing them from spreading to release the ball R. When it is desirable to uncouple the cars, either the shaft O, or the shaft P, will be rotated to wind up the chains *q q′*, which winding of the chains will move the lever N,

Patented Articles.

IT would seem to be a mistaken policy to rate patented articles at what are sometimes prohibitive prices, and much of the opposition which has been developed of late years toward patents arises from the unreasonable prices asked for the goods themselves. We were recently shown a certain article of household use which is a necessity. The cost to manufacture it could not exceed one dollar, for the material was common and there was no skilled workmanship upon it anywhere, yet the retail price of this apparatus was $10. Such prices are prohibitive for two reasons: one being that not all persons can afford them, and another, that buyers are generally able to tell whether they are getting value for their money or not, and estimate very closely between cost of production and retail price. The argument of the seller seems to be, in some cases, that the article is patented and he is therefore entitled to demand whatever he chooses, and that it is a sufficient answer to any objection that it *is* patented, and cannot be had unless the sum demanded is received. This seems to us to be a wholly erroneous position, and the reply should be that, inasmuch as a given article is patented the maker is ostensibly protected, and can therefore rely upon his rights to vend for the life of the patent. Moreover, commercial considerations should convince retailers of patented devices that popular prices sell more goods than unpopular prices. There is really no reason why patented articles should sell for any higher price than those not patented. The public does not buy them for the patent mark, but for their utility, and if the goods

are what is claimed for them the buyer attains his end more rapidly with popular prices than with high prices.

Instances are not wanting where the sale of really meritorious patented articles has been destroyed by the cost of them, but when the patent had expired, and the trade were free to make them, these goods were again put into market and had an enormous sale at lower prices.

Persons must judge for themselves as to what value they put upon their goods, but it would seem sound judgment to so rate them that the million could purchase rather than a few here and there.—*Mechanical Engineer.*

Railway Employés in Australia.

A CORRESPONDENT of the Indian *Railway Service Gazette*, who formerly ran a locomotive in India, writes as follows from Geelong, Victoria:

"I must inform you that the railways here are behind yours in some respects, but not in others. They have got all the best brakes and signals, and they say they have slide-valves that have run 130,000 miles without anything being done to them; but they are behind in their rolling-stock, which are unpleasant to ride in from the continual jolting, and the method they have of working single lines is fraught with danger. They work them on the staff system, and many accidents have happened in consequence thereof. There is nothing like the line-clear message system. As regards labor, there is no chance in Victoria for railway men to find employment. The railway companies bring up their own men, and a first-class body they are. I don't think you could find better anywhere. As a rule they do not work longer hours than men in India, but they don't have shed days, and considering the climate I think those employed on engines here have the best of it. Engineers get from 13 to 15 shillings a day ($3.17 to $3.65); firemen, 9 to 10 shillings ($2.19 to $2.43); but all these have been cleaning in the service and begun before they were twenty-five years of age. They must pass an educational test, be of a certain height, five feet six inches, and of good moral character. All the old hands get compensation—a month's pay for every year in the service—when they retire; and I am told the new hands have to insure their lives upon entering the service. All claims have to be settled by the railway commissioners. Locomotive-men are without a doubt the best paid servants of the State. Sunday work is not known out of Melbourne. A lot of lines do not pay, owing to the sparsely populated country they run through. Don't let any man be foolish enough to come here, if you can help it, to look for work."

Longest Line in Europe.

THERE is only one European railway company with a mileage anywhere near as great as the largest of ours, namely, the Paris, Lyons and Mediterranean, with 4,783 miles; but it has larger earnings than any American system worked under a single management. The largest earnings per mile in France are by the Northern (2,160 miles). These great systems, like ours, include some lines with an immensely heavy traffic and others with very light business, usually embracing all lines in a given district, many of which the companies were required to build, as one of the conditions of their charters. The French-Algerian roads make a very poor showing indeed. The French State railroads, including 1,420 miles of exceptionally unproductive lines, earned $3,281 per mile last year.

The Land Grant of the Texas Pacific Railroad.

THE land grant of the Texas Pacific Railroad lies in Texas and embraces 1,128,000 acres of located land and State warrants calling for 1,300,000 more, making in all 2,428,000 acres. The grant is mortgaged for about $2,200,000, which would be considered a very light lien but for the fact that the land lies in Western Texas, somewhat beyond the agricultural belt; still it ought to average about $1 per acre. The general committee to bring matters to a head is composed of Messrs. Fordyce, Clark, Paramore, Bemis, Kerns, Gilkerson, Wolff, Woerishoeffer and Phillips, with Wolff and Phillips a special sub-committee to work up the details.

French Railway Mileage.

THE length of railway of general interest in operation in France at the close of 1885 was 19,059⅜ miles, as compared with 18,366⅞ miles in working at the close of 1884. It follows that 692½ miles of line were opened for traffic in the course of last year. The length of line of local interest in working at the close of 1885 was 1,106⅞ miles, as compared with 1,001¼ miles at the close of 1884.

GENERAL OFFICES **THE ROTE AUTOMATIC BRAKE COMPANY,**

MANSFIELD, OHIO, *November 3d, 1884.*

To the Westinghouse Air Brake Company, Pittsburgh, Pa.:

GENTLEMEN:—Understanding from your published announcements that you recommend your brake for freight-train use we respectfully invite you to a complete and searching public test of its merits in competition with the *Rote Automatic Brake* This test to be made in so complete and critical a manner as to show all the railroads of the country, as well as the Railroad Commissioners of the various States, which of the two brakes is the one which should be used; for the test will, we are certain, leave no doubt in the minds of any witnessing it.

To insure the proper management of the test we suggest that you choose one person, we another, and these two a third person, all three to be well known as capable and honorable rolling-stock experts, to conduct the test, their expenses to be jointly borne by you and by us.

An invitation to witness the test to be extended to the General Officers of Railroads and all State Railroad Commissioners to the members of the National Car-Builders Association, and to the Railroad and daily press.

The test to be at such time and place as may be mutually agreed upon, but we suggest that the proper place would be on some road having high grades and sharp curves, so that both brakes may have as hard and complete a test as possible. As it is necessary to make the test searching and complete, and as all railroads wish to increase the length of their trains and only wait for a brake which will enable them to do so, we think each train should be made up of 50, 60 or 70 cars, as you may prefer, or, if you think best, of even more cars.

Your company to supply your train and engines, we to supply ours.

The following points, among others, to be considered and reported upon:

Cost of equipping trains.

Simplicity.

Freedom from breakage.

Certainty of action.

Effectiveness.

Cost of maintaining.

"Flatting" of wheels.

Any other points submitted by you or by us in writing to be added to the above.

The brakes or trains are to be tested in every manner and under all conditions which practical railway service may suggest, including yard as well as line service.

Among others the following tests are to be applied to both trains:

1st.—Each train is to be (part of the time) run by engineers and crews who have never operated either brake and who are wholly unfamiliar with them.

2d.—The trains are (part of the time) to be partly made up (as nearly all freights are everywhere) of foreign cars, which have neither your nor our brake on, so that the cars having your break or ours on shall be widely and irregularly separated from each other.

3d.—The locomotives drawing your train and ours to be exchanged, from time to time, and draw each others trains.

4th.—Two locomotives equipped as so many freight engines and tenders are, with hand-brakes instead of steam or air brakes, are to be substituted for the two engines used in the test part of the time. Any brake which will not work properly if this is done, you will admit, can be of little practical value in actual service.

5th.—From time to time each train is to be stopped and foreign cars (not equipped with either your brake or ours) are to be run into it, at irregular intervals, just as actual service requires constantly.

6th.—In the making up of trains, etc., crews are to be exchanged at random, so that the test may fully illustrate the convenience of operating each kind of brake in actual ordinary service.

7th.—Frequent short runs, stops and quick starts are to be made.

8th.—A series of yard tests are to be made, showing the action, convenience, etc., of the two brakes.

We mention a few necessary tests only, and you and we, as well as the test committee, are to add any number of others, it being distinctly understood that if you decline any test proposed by us, or we decline any proposed by you, it shall be condered an explicit and positive admission of inferiority.

This rule must in every case be strictly observed, namely: *Both brakes must be tested in precisely the same manner*, so that there may not only be absolute fairness, but no room for suspicion even of anything else.

You have been in the brake field a long time, have profited justly and largely from the patronage of railroads, and we are sure will welcome this plan for allowing your patrons and the American public to judge for themselves which brake should come into universal use.

Having proper confidence in the merits of your brake we know you will gladly and promptly accept our proposition herein made, as you must feel that the test will be complete.

The railroad public is a very fair-minded, capable body, and will most thoroughly appreciate and fully recognize the equity and fairness of our offer to you, and, in common with business-like people everywhere, will naturally (and, we are sure you will admit, properly) consider it a virtual confession of inferiority and a public admission that the Westinghouse Brake is inferior to the Rote Brake and that it is unfitted for general freight service, should you decline or neglect to avail yourselves of the proposition we make you herein.

Permit us to add in closing that we wish to express to you our desire to have this communication received in the spirit in which it is sent, and to have it express to you our wish for a full, fair and searching test of the two articles in the relative merits of which the railroad interest is *primary* and that of the owners even secondary. Respectfully,

THE ROTE AUTOMATIC BRAKE COMPANY,

Per M. D. HARTER, President.

American Railroad Journal.

WHOLE NO. 2,578.] NEW YORK, JULY, 1886. [VOLUME LX.—No. 4.

TRADES UNIONS AND STRIKES.

THE following portion of a chapter on the above subject is, with the consent of the publisher, reprinted from the last edition of "Fawcett's Manual of Political Economy."* It will be discovered by the reader that this chapter, like all the others in the book, is admirably clear, comprehensive and impartial, and, so far as those characteristics are concerned, it is in marked contrast to much that has recently been written and published on the "labor question."

The frequency of strikes has for a considerable period been a prominent feature in the social condition of England. The laboring classes would not always be ready to make such great sacrifices to support a strike, unless they believed it was an efficient remedy for low wages. The subject demands a careful and dispassionate consideration, for the prejudices of each party in the dispute are so strong, and the feelings excited so angry, that little is heard but useless recrimination and unreasoning partisanship.

According to popular ideas, strikes are inseparably connected with trades unions, and it will therefore be necessary, in the first place, to settle the much disputed question as to the purposes which trades unions are intended to fulfill. A royal commission, after an elaborate investigation, made a report in 1869 upon trades unions. From this report and other sources of information the following conclusions may be deduced: Trades unions serve two distinct purposes. In the first place a trades union performs the ordinary functions of a friendly society. A member of one of these societies is assisted, when thrown out of work either by illness or the stagnation of trade. It is not here necessary further to discuss the effects of a trades union, when it is simply used for the charitable purposes just indicated. But a trades union is always something more than a friendly society; its chief object is to organize the workmen of a particular trade into a combination, sufficiently powerful to enforce various regulations, both upon masters and men. The promoters of trades unions seem distinctly to understand that the most effective way to raise the wages in any particular trade, is to restrict the number of laborers who are employed in it. Consequently many of the rules of these societies are framed with the specific object of artificially limiting the supply of labor. Thus some trades unions will not permit a master workman to take more than a certain number of apprentices. In the hat trade the number is limited to two. If the union has sufficient power to enforce obedience to its mandates, any restriction which limits the number of those brought up to the trade must exert a direct influence to raise the wages which are paid in this particular branch of industry. For suppose that those who are engaged in the manufacture of hats were freely permitted to take as many apprentices as they pleased, the number of journeyman hatters in the country might be very much increased. Let it be assumed that there would be twenty per cent. more journeymen hatters than there are now; under these circumstances, there would be a greater number of laborers competing for employment in the hat trade, and their wages would consequently be reduced. The saving resulting from the lower wages will ultimately benefit those who purchase hats, because the price of hats would be reduced. The hat manufacturers would not be able to appropriate to themselves the savings which would accrue from the payment of a less amount in wages, because, when the cost of producing any commodity is reduced, its price is sure to be lowered in a corresponding degree, since people engaged in the same trade compete against each other for as large an amount of business as possible; and in their anxiety to undersell one another, they offer their commodities at a price just sufficiently in excess of the cost of production to leave them the profit ordinarily realized in trade. It therefore appears that those who purchase any commodity are compelled to pay a higher price for it, and that the wages of the laborers engaged in its manufacture are artificially raised when restrictions are imposed which limit the number of those who are permitted to be employed in the particular trade.

These restrictions can on no grounds be defended; in the first place, any such interference with the distribution of the labor of the country, amongst its various branches of industry, introduces many most mischievous inequalities. The labor of which some employments are compulsorily deprived is thrown, as a burdensome surplus, upon other branches of industry; and the wages in some employments are consequently as much depressed as the wages in others are raised. The members of a trades union, when they usurp such powers, virtually confiscate to their own advantage a portion of the wages which would be paid to other classes of laborers if industry were unshackled by such arbitrary rules. Although this injustice is striking, yet there still remains to be described a much greater wrong, which is inflicted upon those who are prevented by a trades union from following the employment they would select, if left to their own free choice. There is no right to which all men and women have a more indefeasible claim, than absolute freedom to follow those pursuits in which they think they are best qualified to succeed. The laws of a free country ought to secure to every one this right; for if it is denied, individual freedom ceases to exist. Such a right is denied, if a person is excluded by a trades union from following a particular employment. It is no excuse for the members of the union to say, Our trade is already

* "Manual of Political Economy," by the Rt. Hon. Henry Fawcett. Macmillan & Co.

overcrowded, wages are too low in it, and it would be disastrous if they should be still farther reduced by an increase in the number of those applying for employment. Every man has a right to judge of such things for himself; he may wish to engage in the trade because he has a particular capacity for it, and if he is arbitrarily driven to some other employment, he is deprived of the advantages of the skill with which nature has endowed him. It would therefore seem that trades unions may inflict upon laborers great social tyranny. It is not the laborers who alone suffer, for every class of the community is more or less injuriously affected. These trades unions may imperil the very existence of an industry in any particular district; for the various restrictions imposed upon employers may so much increase the cost of a commodity as to render it impossible for them to compete against others in the same trade, whose operations are not similarly impeded. Examples may be quoted which prove that some branches of industry have been driven from certain localities by trades unions. The societies have long been very powerful in Birmingham, and their efforts were at one time chiefly directed against the introduction of machinery. These efforts were in a great degree successful, and consequently when steam began to be generally applied, those trades which required much machinery settled in other localities, and the manufactures of Birmingham are to this day in a great degree confined to those branches of industry which require comparatively a much greater amount of manual labor than machinery.

It may perhaps be asked: How can these trade societies exercise the influence they do, when every one is aware that the coercion they practice is not based on any legal sanction? No one can doubt that the members of a trades union commit a criminal act, if they attempt, in the slightest degree, to interfere with any individual who does not belong to their society. It would therefore appear that social terrorism is the source of their power; for although such outrages as those committed at Sheffield are exceptional, yet a non-union man is subjected to so many petty annoyances that his life not unfrequently becomes a burden to him; and employers are coerced in a similar manner, if they do anything contrary to the rules of a trades union. Thus if a master, engaged in some business such as wool-stapling, where the trade is all powerful, were to employ non-society men, all his laborers who belonged to the trades union would at once refuse to work for him, and he would in this way be subject to great loss and inconvenience.

It is not, however, these regulations concerning the internal arrangements of a trade, which have caused so much public attention to be directed towards trades unions; the interest excited in these societies has been in a great degree due to their connection with strikes. The trades unions have, in fact, endeavored to regulate wages, and then apply their organization to compel employers to agree to their demands. If, for instance, it is proposed to reduce the wages in some particular branch of industry where the majority of the men employed belong to a trade society, then, if the leaders of the society consider that the reduction ought not to be made, they issue an order that work should be discontinued rather than accept the reduction. If the reduction is still insisted on by the employer, the immediate consequence is a turn-out of the workmen, or, in other words, a strike. Now it is evident that a trades union need not necessarily have the slightest connection with a strike; even if trades unions did not exist, strikes might be of frequent occurrence. A strike implies a combination amongst a large number of workmen, and such a combination is not possible unless a considerable majority of those engaged in any trade agree to act in unison. Such combined action as a strike requires cannot therefore exist unless the workmen submit to be governed by an organization. The trades unions supply this organization, without which there cannot be complete unity of action. It is quite possible, however, to conceive that a trades union may prevent a strike, and many of these societies have, as yet, never been connected with a strike; still, as long as a great number of workmen in this country are warm advocates of the system of strikes, it is quite certain that trades unions and strikes will be intimately connected together.

Since a strike requires combination, we have to inquire, when investigating the effect of strikes, whether workmen by combining can obtain higher wages. It can scarcely be disputed that they possess a perfect right to combine. The right may be, and has been, abused; then, of course, it ceases to be justifiable; but if employers are freely permitted to invest their capital to the greatest possible advantage, the employed may equally claim to be allowed to obtain the highest wages they can for their labor. If, therefore, any number choose to form themselves into a combination, and refuse to work for the wages which are offered to them, they are as perfectly justified in doing this as capitalists are when they refuse to embark their capital because the investment offered is not sufficiently remunerative. Workmen, however, do an illegal and most mischievous act, which ought to be severely punished, if they attempt to sustain the combination by force, or if they coerce individuals to join it by threatening to subject those who keep aloof either to annoyance or personal violence. Workmen have sometimes maintained their combinations, not only by acts of violence, but also by various kinds of social terrorism. Justice obviously demands that the blame which attaches to such actions should not be borne by those who never abuse the power of combination. An increasing number of the intelligent artisans of this country each year become more decided advocates of trades unions. The influence of these societies is rapidly extending in other countries; it is therefore very important to ascertain the effect exerted upon wages and upon the general condition of the laborer by a legitimate use of the power of combination.

It is interesting to remark, as pointed out in "The Economics of Industry" (p. 189), by Mr. and Mrs. Marshall, that when trades unions first began to be formed at the beginning of this century, they directed their efforts mainly to obtaining the revival of certain restrictions in trade, such as a limitation in the number of apprentices, which had been framed in the time of Mary and Elizabeth. Gradually, however, instead of asking for Government interference, trades unionists have so successfully directed their efforts to free themselves from Government interference, that now the right of combination has been fully recognized and workmen are freely permitted to combine in any manner which would be lawful to other persons.

When investigating the effect of trades unions on wages it is essential to keep clearly in view the fundamental distinction between the permanent and temporary consequences which arise from the operation of an economic agency. In every branch of industry there is a certain position of equilibrium to which profits and wages have a tendency to approximate. A long time, however, may be required to restore wages and profits to this position of equilibrium. Thus the woolen trade cannot permanently continue very much more profitable than the cotton trade, because the competition of capital will gradually induce capital to be invested in the one trade and withdrawn from the other. Competition cannot exercise this equalizing force instantaneously; it takes, for instance, a considerable time to erect new woolen mills, and there will always be much hesitation before men will relinquish such a business as the cotton trade, to which they have been accustomed. Hence, one branch of manufacture may continue for many years exceptionally prosperous, whilst in some other business there may be a corresponding depression.

Competition exerts a similar equalizing influence upon wages. If wages in one branch of industry are exceptionally high, whilst in some other they are exceptionally low, labor will be gradually attracted to the business in which the high remuneration is given, and will be withdrawn from the business in which the remuneration is less than the average. But here again time is required for carrying out this equalizing process. Laborers will rather submit to some temporary loss than change their occupation. A considerable expense will also be incurred, if a man has to change his residence in order to obtain a new employment. In some cases it happens that such obstacles as these neutralize the force of competition, not temporarily, but for an indefinitely long period. For instance, the wages of agricultural laborers in some localities are permanently depressed below the average rate. The reason of this is, that the force which competition would exert to advance these wages is neutralized by the laborer being prevented through ignorance and poverty from resorting to those localities where wages are higher. These general remarks enable us more exactly to determine the influence which can be exerted upon the condition of the laborers by the power of combination.

If competition acted simultaneously, or in other words, if profits and wages in every branch of industry were always at their natural rate, it might be at once concluded that the power of combination could exercise no effect either upon profits or wages. Suppose, for instance, that workmen by resorting to a strike obtained an advance in wages. This advance would be of no benefit to them, if the competition of other laborers, anxious to participate in this advance, could immediately produce its equalizing effect. No conclusion of any practical value can be arrived at on the subject unless the mode in which competition acts is kept steadily in mind. In all those branches of industry in which the competition of labor and capital freely acts there cannot be secured any permanent increase in profits or wages, by a combination either of employers or employed. It has, however, been previously remarked that in some cases the equalizing effect of competition is neutralized through an indefinitely long period. This occurs with regard to agriculture in those counties where the wages are the lowest. When a branch of industry is in this position, there can be no doubt that laborers can, by combining, secure a permanent advance in wages. Suppose, for instance, that when the Dorsetshire laborers were earning only ten shillings a week they received so much extraneous assistance that they were able to maintain a prolonged strike. The farmers, under such circumstances, would almost inevitably be vanquished in the struggle. They would be ruined if their land remained uncultivated, and since the wages previously paid were minimum wages, it would be impossible to obtain labor from other localities unless a higher remuneration were offered for it. The power of combination has, within the last few years, since the establishment of agricultural laborers' unions, produced some effect in raising the wages of our worst paid agricultural laborers. When these combinations become more general, various other agencies, such as migration and emigration, will be brought into operation to raise wages. It now remains to investigate the influence which a power of combination may exercise upon wages and profits, during the time which always elapses before competition can produce its equalizing effect.

When men labor simply for hire, it is manifest that the adjustment of wages is analogous to the bargaining which is carried on by the buyer and seller of a commodity. Although it is no doubt true that the price at which a commodity is sold, approximates to the cost at which it can be produced and brought to market, yet the price at which it is actually sold is often to a considerable extent influenced by various circumstances which may happen to place the buyer in either a better or worse position for bargaining than the seller. In a similar way wages ultimately depend upon the amount of capital and upon the number of laborers; yet the wages which, at any time, are paid in a certain trade are to a considerable extent influenced by the relative advantages possessed by employers and employed for carrying on the bargaining by which wages are adjusted. The question therefore arises, will workmen by combining, or by showing that they have the power to combine, improve their position in carrying on this bargain?

(*To be continued.*)

REPORT OF THE NEW YORK RAILROAD COMMISSIONERS ON THEIR CAR-COUPLER TESTS.

THE board of railroad commissioners have made public their decision and recommendation upon their car-coupling tests recently made. They issue this statement:

The authorities of the New York Central and Hudson River Railroad Company courteously put at the disposal of the board every facility to make the trials as complete as practicable under the circumstances. The tests were made upon the curve of a side-track and under such conditions as would most frequently occur in practical operation. Thirty-three different couplers were represented. The points and requirements particularly considered were as follows:

First.—Facility to couple with its own kind with same or different height of draw-bar.

Second.—Facility to uncouple under all circumstances.

Third.—Facility to couple with common link-and-pin, and whether automatic or not.

Fourth.—Certainty to hold on uneven track.

Fifth.—Capacity to set so as not to couple when "kicked" into side-tracks, etc.

Sixth.—Non-liability of obstruction by dirt, snow, ice, rust, etc.

Seventh.—Strength to resist concussion.

Eighth.—Certainty of knowing which car to uncouple in the dark.

Ninth.—Position of device to raise pin so as not to be above floor of car, with reference to applicability to platform cars.

Tenth.—Non-interference of uncoupling device with brakeman guiding link into old draw-bar.

Eleventh.—Simplicity of construction.

Twelfth.—Cost.

The importance of the subject is shown by the fact that the average number of deaths from coupling per year in this State for the last two years has been sixteen deaths and 380 injuries to person.

The board had three principal objects in making the tests:

First.—To give an opportunity to inventors to display their devices in a public way.

Second.—To see what devices presented fulfilled the requirements of the law.

Third.—To take another step toward determining, if possible, which is the best coupler.

The first two objects were attained. Some, but not much advance was made toward the third. There are so many devices having merit, yet none without objection, that the board would be greatly embarrassed were it required to positively recommend any one to the exclusion of all others. This may seem a somewhat disappointing conclusion, but it is the only one possible under the circumstances. If the merits of all could be combined in one, a perfect coupler would be the result, but it must be remembered that every little improvement is patented, and, until sufficient essential patents are the property of one party, a perfect device seems impossible. In the analogous case of the Westinghouse air-brake a vast number of patents have been purchased by the Westinghouse company in addition to the original invention of Westinghouse, and so with almost every other device which is in final successful operation.

The board proposes to give this subject its continued attention. The impressions and views it now holds it gives with due caution, reserving the right to alter or amend them as circumstances and increased investigation and experience may warrant.

To attain the main object of an automatic coupler, *i. e.*, to save the limbs and lives of trainmen, it is most desirable that but one device should be in universal use. If there is diversity it will increase rather than diminish the present dangers.

There appear to be but two ways for this to be brought about, one by the operation of the law of the "survival of the fittest," the other by the creation by congress of a commission to determine upon one coupler and compel its adoption by all companies engaged in inter-State commerce.

The first method, it would seem, will be slow beyond all computation from present indications. There appears to be no good reason, however, why the second could not be done.

Under its powers to "regulate commerce among the several States," congress has already prescribed rules for the inspection of hulls and boilers of steamships, for the examination of engineers as to their competency, for vessels being provided with boats, life-preservers, and for many similar things to insure the safety of travel by water.

It would seem that the same power could and should be exercised to insure safety in the operation of railroads.

From the diversity of the recommendations made by the States which have already acted on the coupler question, it seems to be hopeless to secure unanimity from them acting separately.

One is embarrassed at the outset of this subject with the fact that there are two rival and irreconcilable classes to deal with—first, the so-called "vertical plane couplers," and second, the link couplers.

VERTICAL PLANE COUPLERS.

Some of the practical difficulties with the vertical plane class are:

First.—None of them, as at present manufactured, with the exception of the Cowell and Janney, couple automatically with any other.

This difficulty could be remedied to a great extent by having the movable knuckle universally on the right side, and of the same size. But positive objections are made by the Hein company, for instance, to altering the proportions of the coupler, on the ground of destroying its strength.

Second.—None of them undertake to couple automatically with the old link-and-pin, except the Cowell.

This is a most serious objection, for the reason that the slot into which the link goes is much smaller than in the old draw-head, and the danger to the brakeman of getting his hands caught correspondingly greater.

The cars with which many of them are equipped are not provided with deadwoods, so there is no protection for the trainmen in case of the draw-heads being broken by concussion. Deadwood blocks should be provided in all cases.

The device to couple and uncouple is frequently in the way and adds another danger.

In the case of the Cowell a throat is cut in the face to take a link. There is a dog moved by a spring to hold the pin up. This dog is intended to be pushed back by the link and the pin to fall automatically. The difficulty is twofold.

First.—The link would only be pushed in by a draw-head having a solid throat. (This difficulty is common to a great many.)

Second.—The throat in the Cowell is so shallow that the link strikes before the draw-heads come in contact, so the link would take the whole force of the blow in coupling, and would bear the whole strain pushing—conditions which would bend or break it.

Third.—Almost all of the vertical plane couplers appear to be more or less liable to become fouled by dirt or rust if left standing for some time exposed to the weather, al-

though there is quite a difference in them in this respect; the contrivance to catch the arm and hold it in place being quite complicated in some and simpler in others.

LINK COUPLERS.

Link couplers as a class present certain obvious advantages. They are simple in construction, cheap, not so liable to get out of order, conform better to the present method of coupling, and afford more "slack," thus allowing a long freight train to be more easily started than if coupled with the closer "vertical plane" type. The board does not propose to discuss the question as to which class forms "mechanically" the more perfect union. It is sufficient to say that either forms a sufficiently perfect union. The advantage which many of the link class possess of coupling automatically with the old draw-head the board deems of great importance. It will be many years before the latter is entirely discarded from the railroads of the country, and, therefore, forms an important factor in the problem.

A serious difficulty, however, with this type is that none of them will couple automatically with the old draw-head unless the latter has a closed throat, so that the link will be pushed on to the hook or against the dog to allow the pin to drop, as the case may be.

All those familiar with the subject will recognize that this requires a link of a standard length, and a throat both in the old draw-head and in the automatic draw-head of a standard depth, shallow enough to insure the link being pushed so as to secure connection, and deep enough to permit the draw-heads to come in contact after connection.

Inasmuch as a very large proportion of the old draw-heads are either "skeleton" or hollow too far back, this requirement makes an automatic coupling with them impossible.

It is desirable that a standard link be adopted and that all draw-heads be provided with a stop in the throat so as to permit the link to enter but half an inch beyond its middle point. This could be done at a trifling expense.

It is quite obvious, therefore, that any automatic coupler requiring a link longer than the standard (say ten-and-a-half inches inside measurement) is essentially defective. This is equally true with regard to any fixed link coupler.

It is also asserted that any hooked coupler (such as Archer, etc.), is apt to have hook wear away, thus rendering uncoupling liable—this fact gives an advantage to a pin.

The law of the State as it exists to-day is very broad. It provides that no coupler shall be placed upon any new freight-car * * * "unless the same can be coupled and uncoupled automatically without the necessity of having a person guide the link, lift the pin by hand, or go between the ends of the cars."

Such coupler might be defective, however, in many of the respects heretofore pointed out. The strict legal duty of the board would be fulfilled in seeing that the railroad corporations adopt such devices as come within the law, however defective in other respects; and, indeed, it is the only positive power vested in the board in the premises. It has deemed it better, however, to call attention to the matters hereinbefore mentioned and to make the following recommendations:

CONCLUSIONS AND RECOMMENDATIONS.

The board of railroad commissioners recommends:

First.—That the standard height of draw-bar of the Master Car-Builders' Association, viz.: two feet nine inches from top of rail to center of draw-head when car is empty, be adopted by all railroad corporations; that new cars be made to conform thereto, and that old cars when repaired be made to conform as nearly as possible.

Second.—That all freight-cars not having platforms, be equipped with "deadwood" blocks to conform to the standard of the Master Car-Builders' Association.

Third.—That a standard link be adopted of ten and one-half inches inside measurement, and thirteen inches outside measurement.

Fourth.—That all existing link-and-pin draw-heads be provided with a stop in the throat to prevent a link entering more than seven inches.

Fifth.—Of the couplers presented to be tested on the 16th and 17th of June, the board finds the following to fulfill the requirements of the law.

There are many others of which the board has drawings or models and which possess merit, but as to them the board makes no mention, for the reasons, first, that cars were not equipped with them, and, second, that but little weight can be given to the working of a model alone.

Those practically tested are divided:

First.—Into classes mentioned in what the board regards as the order of merit.

Second.—Each coupler is mentioned under its class in what the board regards as its order of merit.

FIRST CLASS.

A.—Link and pin couplers; pin held up by catch or "dog." The "dog" is thrown back by link entering, allowing pin to drop automatically—uses standard link and couples automatically with old draw-bar if stop in throat, or,

B.—Beveled pin permitting link to slip under:

Hoag, McKeen, N. Barr, Perry, United States, Robinson, Keeler, Sherman, Thurber, Whitman Kilmer (beveled pin), Wilson (beveled pin).

SECOND CLASS.

Vertical hook and link. Link pushed on to hook. Couples automatically with old draw-bar if stop in throat: Archer, Aikman, Marks, Smillie, Baldwin, Fennell.

THIRD CLASS.

So-called "vertical plane couplers." A "knuckle" opening in a horizontal plane, fits into a corresponding knuckle on other draw-bar—does not couple automatically with old draw-head, except Cowell, which has throat in face:

Janney, Barnes, Cowell, Thurmond, Dowling, Hein, Titus & Bossinger, Boston Automatic, Lorraine.

FOURTH CLASS.

Fixed link. Does not couple automatically with old draw-bar:

Ames, Curtis & Wood, Adams, Felthausen & Lawtenslager.

MISCELLANEOUS.

Powell; Has a toothed wheel to serve for pin. Ingals

ous but practicability not been demonstrated. Couples automatically with old draw-bar:

Wood & Drake, doubtful utility. Kaltenbeck, doubtful utility.

REPORT OF COMMITTEE OF THE MASTER CAR-BUILDERS' ASSOCIATION ON STANDARD DEAD-BLOCKS.

AFTER giving a history of the action of this association with reference to standard dead-blocks and the height of draw-bars for freight-cars, the committee on this subject concluded its report to the last convention as follows:

Your committee are quite well aware of the disfavor with which any change of standards already adopted by the association is regarded—and properly so—by a majority of its members. Nevertheless, if there is good reason for making such a change, the sooner it is done the better. In the case of the standard dead-blocks, it will be seen that the height from the tops of the rails to the under side of the sill is 3 feet. This would make the height to the center of the dead-block 40 inches. The height of draw-bars and dead-blocks of twenty-four of the principal railroads is given in the following list:

NUMBER OF CARS OWNED BY, AND STANDARD HEIGHT OF DRAW-BARS AND DEAD-BLOCKS ON DIFFERENT ROADS.

	Number of Cars owned.	Height from top of Rails to center of Draw-bar.	Height from top of Rails to center of Dead-block.
		Inches.	Inches.
New York Central & Hudson River	31,117	33⅝	44
New York, West Shore & Buffalo	7,721	33	42
Pennsylvania	47,013	35	42¾
New York, Lake Erie & Western	31,000	34	42¾
Lehigh Valley	24,247	35¾	....
Delaware & Hudson Canal Co.	11,392	33½	43¾
Buffalo, New York & Philadelphia	5,680	34	43¾
Delaware, Lackawaona & Western	24,000	32½	....
Chicago, Burlington & Quincy	17,940	33	40¾
Chicago, Rock Island & Pacific	8,081	33	40
Chicago & Northwestern	21,000	33	41⅛
Illinois Central	9,075	33	41½
Grand Trunk	10,375	33	41
Intercolonial	4,745	33	40½
Missouri Pacific	18,050	33½	42
Central Vermont	3,256	33	40¾
Burlington, Cedar Rapids & Northern	4,307	35	42
Mobile & Ohio	1,553	34½	41½
Louisville, New Albany & Chicago	2,286	35	43½
Chicago, Milwaukee & St. Paul	20,408	33½	41¾
Detroit, Lansing & Northern	2,681	33	39¾
Chesapeake & Ohio	5,953	35	43½
Baltimore & Ohio	21,912	35	44½
Chicago & Alton	6,666	35	43½

From this it will be seen that on only two of the roads are the dead-blocks placed as low as the standard height. All the other roads place them higher. This is tolerably good evidence that the standard height is too low.

By comparing the height of draw-bars, in actual use on the different roads named, it will be seen that a majority—14 of them—are over 33 inches high. If we count the cars owned by those roads, we find that those lines which place the draw-bars higher than the Master Car-Builders' standard, own 231,674 cars, whereas those which have adopted 33 inches or under, own only 108,874. It is fourteen years since the standard height of 33 inches was recommended by the Car-Builders' Association, and yet it has not secured a more general adoption than the figures which have been quoted indicate. All of the members of the Car-Builders' Association will agree that it is very desirable to secure uniformity in the height of draw-bars. The question then comes up, with the prevailing practice which has been described, what is the best method to adopt to secure uniformity? Is it to adhere to the standard which was adopted fourteen years ago, or would the end aimed at be best secured by a modification of it to suit the existing practice of the principal lines?

Doubtless, if the standard was to be established to-day it would be made higher than it was in 1872. As already stated, in 1884, when the standards were revised by the executive committee, they recommended that the height of draw-bars should be 2 feet 9 inches "when the car *is loaded to its full carrying capacity.*" The association overruled the recommendation of the committee, and made 33 inches the height when the car is *empty*. The discussion of this subject, however, revealed that many of the members misunderstood that the standard height was to be measured when the car is *loaded*. In recommending a standard for dead-blocks the committee at the outset have encountered the difficulty that the present height of draw-bars is *too low*, and as it determines, to some extent, the height of the dead-blocks, the committee were compelled to consider the one standard as well as the other. The question which they felt obliged too entertain was that which has already been stated, that is, what action of the association will be most certain to bring about uniformity in the height and dimensions of draw-bars and dead-blocks? On careful investigation your committee were compelled to conclude that some modification in the standard height of draw-bars and dead-blocks is essential to secure their general adoption.

They therefore recommend:

First.—That the standard height of draw-bars for freight-cars, measured perpendicularly from the tops of the rails to the center of the draw-bar, shall not exceed 2 ft. 11 in. when the car is empty, nor be less then 2 ft. 9 in. when it is loaded.

Second.—That the height of dead-blocks, measured from the tops of the rails to the center of the blocks, be not less than 3 ft. 5 in. when the car is loaded, nor more than 3 ft. 9 in. when it is empty.

Third.—That when double dead-blocks are used that their vertical height and their width, measured crosswise to the track, be each 8 in., and their thickness, measured lengthwise to the track, be 6 in.; that they each consist of a casting as represented by the drawing submitted with this report.

Fourth.—That when a beam, attached to the end-sill, is used for carrying the dead-blocks, that it be made 36 in. long, not less than 4 in. thick and 8 in. vertical depth.

Fifth.—That in other respects, double and single dead-blocks be made in conformity to the standards heretofore adopted by this association, as shown in the drawings submitted with this report.

Sixth.—The committee also recommend that the nuts on the ends of the truss-rods be seated in cup washers, so as not to project beyond the surface of the end-sill, and that the space between the ends of the cars be kept as clear as possible of bolt-heads or other objects which are liable to catch the clothing or injure those engaged in coupling cars.

Further, the committee recommend the adoption of the following resolution:

Resolved, That the recommendations of the committee on Dead-blocks be submitted to the members of the association for approval by letter-ballot.

CHARLES BLAGKWELL.
GEO. W. DEMAREST.
M. N. FORNEY.

Legislation on Patent Laws.

ON January 26, the Hon. R. W. Townsend, of Illinois, introduced a bill in the House of Representatives, and which has been reported favorably by the Committee on Patents, under the title of "An Act to limit the jurisdiction of United States Courts in Patent Cases, and to protect persons who, without notice, are bona-fide manufacturers, purchasers, venders, and users of articles, machines, machinery and other things for the exclusive use, manufacture, or sale of which a patent has been or may hereafter be granted."

The bill provides:

First.—That United States District and Circuit Courts shall have no jurisdiction to hear or try any case wherein the amount in controversy does not exceed two hundred dollars.

Second.—That purchasers of patent rights for actual use shall not be liable for infringing the same to joint, part owners, or others, of whose ownership or interest they had no knowledge at the time of the purchase, and further,

That no purchaser of any article, machine, etc., who at the time of such purchase was unaware that the same was covered by patent or patents, shall be liable for damages for infringement, until after written notice by the patentee.

Third.—Repealing all law or parts of laws inconsistent with sections 1 and 2.

Fourth.—That suits now pending shall not be affected by the act.

Commenting on this, in a letter to one of the daily papers, Mr. Geo. H. Benjamin of New York says: "The practical effect of this bill will be to utterly destroy a patent system which it has taken a hundred years to build up, and which is being gradually adopted as the best in use, by all the great nations of the world.

"Western legislators seem to have a peculiar spite against patents in general, and lose no opportunity to attempt legislation inimical thereto—forgetting that in a great measure the material prosperity of this country has been due to our liberal patent system and the protection accorded to inventors.

"It will be observed that this bill provides for taking away the right of action, and hence the remedy by injunction, unless the amount in controversy be $200. In the large majority of cases before the courts, it is quite impossible to tell what the damage has been until after the accounting before the master, and further, the question is often not so much the recovery of damages as of restraining further injury; and for this very reason, suits are usually brought on the equity side of the United States Courts. The right of appeal to the Supreme Court of the United States is not limited by the amount in controversy, and it seems rather absurd to create such a limitation in the subordinate courts. In short, this section is not only probably unconstitutional, but in direct opposition to many of the statutes relating to the jurisdiction of the United States Courts, and to patent interests, which would in effect be repealed by the third section of the proposed bill, and hence entail hopeless confusion.

"Relative to the second section of the bill, it establishes a premium upon ignorance and mendacity. In effect it licenses and encourages infringement. A knowledge of the law is always to be presumed, and whether one violates it innocently or with malice he should suffer the prescribed penalty. The 'innocent purchaser' humbug has been made the excuse for all sorts of attempts at vicious legislation. If a man buy a piece of property he will search the title. Why should he not do the same in the matter of a patent right? The Government provides a record, and such search can be readily made and at small cost. There is already a law specially applicable to registry of title of patent rights.

"Again, the bill provides that the innocent purchaser shall not be liable until notified.

"A finds an empty house, takes possession and occupies it, in the absence of the rightful tenant. He claims that he is not liable for trespass, because he did not know it belonged to any one. It is unnecessary to say such an excuse would be of little avail.

"What arguments the advocates of the bill have advanced, I am at a loss to conjecture. There is no doubt, however, that the passage of such a bill would be a severe blow to all the patent interests of the country, and it should not be permitted to become a law."

Odd Results of Railroad Building.

THE two railroads that are engaged in the construction of the spur from the West Shore Depot to Bergen Point, and of the spurs from the several railroad depots in Jersey City to the point at the foot of Hudson City hill, at which the Great Union Depot is to be situated, are having a phenomenal experience with their work. The Pennsylvania Railroad Company is building a high embankment across the streets at the foot of the hill, and then around the east side of the hill. The Junction Railroad Company, in which all the roads, including the West Shore, are said to be interested, is preparing to build a piled trestle at an angle of about 45° with the Pennsylvania Railroad's embankment. The Pennsylvania Railroad system of construction is to erect a simple trestle, and then fill in around it. The trestle and filling are being put on made ground, and it is not an unusual thing for the laborers, on going to work in the morning, to find the trestle and filling twenty feet below the level at which they had been left the night before. One night the trestle sank twenty-eight feet. The city at that point rests on a crust above a marsh of unknown depth, and the filling in done by the road sinks below the earthy crust into the marsh, and, spreading, affects the level of the land many feet distant from it.

At Second street, between Pryor and Merseles streets, there stood eighteen houses. They had been purchased by the Junction Railroad, which is to cross at that point

with the design of removing them to First and Third streets. It was discovered, however, that the filling at the Pennsylvania embankment a block away, sank into the marsh, spread under their foundations, and lifted them in some cases twelve to fifteen feet above their usual level. They were in such danger of falling that their immediate removal became necessary, and all but two have been taken away. At the corner of Third and Merseles streets are six houses, owned three each by ex-Sheriff Cronan and State Treasurer Toffey, that have been raised high in the air by the swelling of the ground on which they stand. They have been shored and blocked up, and it is proposed to let them stay there if possible.

The houses thus affected by the filling-in are at least 150 feet away from the embankment. Second and Third streets at the place indicated are new streets, having just been graded. The phenomenon is not so noticeable at the older thoroughfare of First street, though it is very much nearer to the company's filling than Second and Third are. The houses that face on First street have not been affected, though the swelling of the land approaches so closely to them that their rear yards have been raised into terraces.—*New York Evening Post.*

Proposed Tunnel Across Northumberland Straits.

WHEN Prince Edward's Island, Gulf of St. Lawrence, entered the confederation of the Canadian Dominion, one of the articles of agreement was that communication should be maintained with the mainland of Canada all the year round. In consequence, large sums of money have been thrown away on the *Northern Light* and other steamers, which, it was expected, could force their way during winter through the fields of Arctic ice which block Northumberland Straits. The result has been a complete failure, and the 125,000 islanders, notwithstanding the agreement, are practically shut off from communication with the outer world in the icy months of winter. It is now proposed to keep up communication all the year round by constructing a tunnel tube resting on the bed of the straits. The plans, which have been accepted by the government of the island, have been under the consideration of a committee of engineers, submitted to the Dominion Government, and the scheme is to be brought before the Canadian Parliament in the current session. Four lines have been surveyed across the straits, and a plain or plateau has been found in which the tunnel tube can be successfully laid.

It is proposed to build on each side of the straits piers inside of the "bordice," through which the tube is to be driven for some 2,800 feet, the total length of the huge pipe or tunnel being six and a half miles, or about five and a half nautical miles between the piers. The bottom of the straits shows a very good road bed, the depth of water varying from 36 feet on the island side to about 80 feet in the middle of the straits, and thence ashore on the New Brunswick side, 10½ feet. The tunnel is to be 18½ feet in diameter, and to be constructed of heavy sections of chilled white cast-iron, 4 inches thick or more, according to depth. Mr. H. H. Hall, of the Submarine Tunnel and Tube Company, of New York, is the patentee of the process of casting the tubes, as well as of the chilled white metal used. It is estimated that at the present market price, the cost of the iron for the tunnel would be £17 per linear foot, making the total estimated cost of the work close upon £1,000,000. The metal is stated to be non-corrosive in sea water, as shown by the exposure for 12 years in the harbor of Sidney. The sections are bolted together by inside flanges, making a water-tight rust joint with a smooth exterior. A connection with the surface could be maintained by a vertical shaft if desired; but, as a railway could be laid through the tunnel as fast as it is built, all the material used could enter that way, a supply of fresh air be obtained, and communication maintained with the shore. Where the depth of water will allow of the obstruction to the channel, the tunnel is to be laid on the natural bottom of the straits; otherwise a channel is to be dredged, in which the tube is to be sunk.

Chinese Railway Scheme.

ON the subject of the recent unsuccessful endeavors of certain German capitalists and iron manufacturers to secure from the Chinese Government a contract for the construction of railways, the *Vossische Zeitung* says:

"A conference, in which representatives of the Deutsche Bank and the iron industry took part, has been held at the Discount Bank, and reports were presented from the delegates in China. From these it appears that a decision on the part of the Chinese Government as to the construction of the railways is not to be counted on with certainty until the Emperor attains his majority—that is, at the end of next year. The reports show, moreover, that the circumstances of the country are not at present of a character to justify the expectation, indulged in on many sides, that railways would be profitable. Besides this, English competition must be carefully borne in mind.

"In face of these reports, it was resolved to recall Herr Erich at once. Another of the three delegates will return in a short time, while the third will remain in China for the present."

The answer received by the deputation from the Viceroy at Tientsin is said to have been: "We will build railways when we are able to manufacture the material in our own country." The reports candidly admit that the result of the mission to China is absolutely *nil.*

To such a frank statement nothing need be added. The gigantic railway scheme, of which so much has been said and written, proves to be a mere myth.—*London Times.*

How Coal Has Been Displaced by Natural Gas.

THE use of natural gas in the manufactories of Pittsburgh has done away with the consumption of 189,850 bushels of coal a day. In 250 working days, which is considered a year by manufacturers, the whole amount of coal displaced would run up to 47,450,000 bushels. Calculating 100 bushels to be an average day's output for a coal miner, it would take 1,600 coal miners to dig this coal, but altogether the use of natural gas has thrown about 5,000 men out of work in this region. It required the use of 633 railway cars to transport the coal. Each of these 30 feet in length, would make a string more than three miles long.

British versus American Locomotives.

A LIVELY discussion of the relative merits of British and American locomotives has been carried on in the columns of the English engineering papers. A correspondent, Mr. John Fernie, who seems to be a British subject, now resident in Pennsylvania, in a recent letter to *Engineering*, sets forth some of the advantages of American locomotives in the following forcible language: "The English straight axle, whether of iron or steel, requires a great deal of special hammer work put upon it. The central portion has to be reduced below the collars and bosses for the wheels; it has to be heated and reheated for this purpose, and there is considerable loss and waste in the furnace, and through cutting and paring cross-ends; and however carefully forged, there is a good deal of waste in the lathe, cutting out for the journals and collars. Now, the American axle is cut from a straight bar forged or rolled.

"There is little waste in cutting it to length, and putting it through a straightening mill; there is only a slight scraping taken off it in the lathe to true it up for the wheels, journals and collars, the latter being shrunk on instead of being solid as in the English axle. In the case of the driving axle the center part is turned a little larger than the portion for the wheels and journals. The eccentrics solid are first pushed on, then the collars are shrunk on, and then the wheels, the end contact of the axle-brasses being made between the bosses of the wheels and the collars.

"Now, as compared with the English axle, we have here:

"1. No distortion of fiber or irregularity of structure arising from the forging.

"2. No sharp corners to weaken or start a fracture when a heavy blow or strain is thrown on the wheels.

"3. Most perfect simplicity and economy; and this simplicity and economy is carried throughout every detail of the American engine. Some of your correspondents have said that any country blacksmith could repair it, and surely this is the very highest recommendation. Scattered over some 130,000 miles of railroads of this great continent, climbing huge mountains, running over the most miserable roads—many without ballast—crawling over rickety wooden bridges, or turning square round a street corner on the overhead railroads in New-York, there is no other engine that could adapt itself to this work; often ditched by washouts in wild, unsettled districts, there is no engine which can be so quickly set on its legs again. Can we wonder our colonists desire it? A machine on which there is not a pound's weight of material more than is required, not a cent's worth more cost than is necessary: there is no other engine which has such steaming qualities, or can take such heavy loads, and this engine is a racer, too, as Mr. Burnett describes it; coming thundering along at more than seventy miles an hour with the brave boys strapped on, coolly taking their diagrams. We hold our breath, and say on what English engine would you like to do this, when, most astonishing, Mr. Burnett trots out a Brighton engine, and with his pencil and paper and a few figures runs the American engine off the road.

"In my former letter I asked, what would American engineers gain by using the plate frames? Let me ask what American railroad companies would lose by using the English crank-axle and the English wheel? Taking the last year's returns of what I consider the model railroad of the world, the Pennsylvania Railroad would, according to their mileage, had they used the English locomotive, have broken from 170 to 200 crank-axles last year. That is, at 200,000 miles per crank. Figure up the forges, steam-hammers, slotting machines, and crank-axle lathes required to turn out all their crank-axles. This same railway last year turned out of their foundry upwards of 100,000 cast-iron wheels, and they saved nearly £60,000 sterling by making them at their own works. Count up the regiment of forges, lathes and slotting machines to turn out 100,000 English wheels in a year, and when to all this you add the copper fireboxes and brass tubes required by the English engine, you will get an idea of not only the loss, but what would be the ruin of the American railways, the adoption of the English locomotive engine.

"I was quite willing to accept Mr. Burnett's estimate that the American engine was £400 cheaper than the English engine, but since he explains away that estimate I must place the different details of the engines opposite to one another, and leave engineers to judge for themselves as to their relative expense, my estimate being that the American engine, say with 16 in. cylinders, would cost less than what I mentioned in my former letter.

English Engine.	*American Engine.*
Boiler, best Yorkshire iron.	Open-hearth steel.
Copper firebox ½ in. thick.	Steel firebox $\frac{5}{16}$ in. thick.
Copper stays.	" stays.
Brass tubes.	Iron tubes.
Crank-axle.	Straight-bar axle.
Straight axles forged.	" " axles.
Plate frames.	Bar frames.
Steel horn blocks.	
Wrought-iron wheel centers drivers.	Cast-iron centers.
Crucible steel tyres.	Open-hearth steel tyres for drivers.
Wrought-iron centres leading.	Cast-iron wheels.
Crucible steel tyres.	Leaders in bogie.

"I conclude this portion of my letter by saying that, in my opinion, no more complicated, wasteful and unscientific form of locomotive engine could be devised than the English engine, and no more simple, economical and scientific than the American engine, and my advice to the English railway companies would be to copy it and to duplicate it as soon as possible.

"Now for results. Well, take our greatest colony, the one nearest our doors, the most loyal, a country of boundless undeveloped wealth, the colony with the greatest railway mileage, and whose very existence and future development depends on the extension of railways and cheap ways of working them, a country where railways have been built with English capital. Does Canada use the English locomotive or the English wheel? and if not, then why not? Surely the example of Canada, Australia, and New Zealand refusing to use the English engines should be enough.

"There is no doubt that in the old times many an English victory was obtained by men not knowing when they were beaten, but brute strength will not win the battle in

these days of science and precision. We must excel the victor in his arts, or copy him. Has England the inventive skill to beat America? What improvements has England effected during the last twenty-five years in railways, and what has America done? Will England copy American inventions and ideas? Certainly not till she is compelled. Look at the first street-railway in London; at Mr. Alport's attempt to introduce the American carriages on the Midland Railway. Take the last case, perhaps one of the very worst, the automatic brake. Now, in my opinion, there was only one good brake in the market, and this was so much the best that there was not even a good second to it; but if reasonable terms could not have been made for its use, then all the companies should have united and adopted the next best. What is the case today? How many brakes are there in England? In America there is practically but one brake, and uniformity is universal, but how can there be interchangeability when there is diversity of apparatus and systems as in England? Consequence is, the railways have to pay for it, and when the system is adopted on goods trains as it is being done here, it will cost the railways perhaps a million to get the best brake, the one that should have been adopted at the first. Yours faithfully,

"JOHN FERNIE, M. I. C. E., England.

"DUNDAFF, PA., U. S. A., June 14, 1886."

Oliver Evans and His Inventions.

IN a lecture on this subject delivered at the Franklin Institute in Philadelphia, Nov. 20, 1885, by Coleman Sellers, Jr., he sums up the work of Evans in the following concluding remarks:

With regard to Oliver Evans' connection with the steam engine, this much we can safely say, that he early conceived the idea of using steam of high pressure, that he lost no opportunity to bring his views to the attention of those whom he thought could assist him in the realization of his hopes; that he built a successful steam engine in 1802; drove a heavy wagon by steam in 1805, and propelled a boat by steam-driven paddle-wheels the same year. That the type of engines he designed (small diameter of the cylinder and long stroke) continued for many years the distinctive American engine. We see that he helped to overcome, by his personal exertions, the universal fear of high pressure steam, and introduced a type of engines which, by their lightness and cheapness, were fitted for the needs of a new settlement. But that he was the first man to conceive the idea of using high pressure steam is scarcely probable; that he originated the locomotive is very doubtful. A Frenchman named Cugnot built a model high-pressure traction engine in 1769, which ran for a time about the streets of Paris, until it upset, and was, with its inventor, promptly cast into prison. The next year he made a second, which is still in existence in Paris, and failed, chiefly because its boiler was too small. In 1784 Murdock made a model high pressure engine, and Watt, in his patent, put forth the idea of a steam carriage for common roads. This was two years before Evans applied for his patent in Pennsylvania. In 1800, Trevethick made an engine with beam, cylinder 19 inches diameter, 5 feet stroke, and, in 1802, he took out his patents. There are certainly many points of similarity between the engines of Trevethick and Evans, but I do not think it is proved that the former copied the drawings of the latter, or even appropriated his ideas. It is much more likely that the two inventors, having the same goal before them, endeavored to arrive at it by the same means, or, as Oliver Evans says of another, "it frequently happens that two persons, reasoning right on a mechanical subject, think alike and invent the same thing without any communication with each other."

In the *Emporium of the Arts and Sciences*, published in Carlisle, Pa., 1812, Evans repeated his oft-quoted prophecy as to the future of the railroad, which was as follows:

"The time will come when people will travel in stages moved by steam engines from one city to another, almost as fast as birds fly—fifteen to twenty miles an hour. Passing through the air with such velocity—changing the scenes in such rapid succession—will be the most exhilarating, delightful exercise. A carriage will set out from Washington in the morning, and the passengers will breakfast at Baltimore, dine at Philadelphia, and sup at New York the same day.

"To accomplish this, two sets of railways will be laid so nearly level as not in any place to deviate more than two degrees from a horizontal line, made of wood or iron, on smooth paths of broken stone or gravel, with a rail to guide the carriages so that they may pass each other in different directions and travel by night as well as day; and the passengers will sleep in these stages as comfortably as they do now in steam stage-boats. A steam engine that will consume from one-quarter to one-half a cord of wood will drive a carriage 180 miles in twelve hours, with twenty or thirty passengers, and will not consume six gallons of water. The carriages will not be overloaded with fuel or water. * * * And it shall come to pass that the memory of those sordid and wicked wretches who oppose such improvements will be execrated by every good man, as they ought to be now.

"Posterity will not be able to discover why the Legislature or Congress did not grant the inventor such protection as might have enabled him to put in operation these great improvements sooner—he having asked neither money nor a monopoly of any existing thing."—*Extract from Address to the People of the United States.*

Freight-Car Brake Tests.

THE committee of the Master Car Builders' Association, which has charge of the tests of freight-car brakes, which are now in progress at Burlington, Iowa, has issued a pamphlet, giving the character and conditions of the tests, of which the following is an abstract:

"Each brake company must furnish 50 box-cars equipped with its brake on both trucks of each car.

"The first tests will begin on July 13 at Burlington, Iowa, after which the cars will be returned to their owners, and the brakes subjected to an endurance test by being put into general service, until the second test is made in April, 1887. In the meanwhile a record of the mileage of the cars and the cost of repairs to brakes will be kept.

"In April, 1887, the cars will be returned to Burlington, and, without being prepared for trial, the July test will be repeated.

"Two eight-wheeled 'American' engines with 17 by 24 inch cylinders, and not less than 51,000 lbs. on the driving-wheels, will be used in the Burlington tests. One engine will be equipped with the Westinghouse driver brake, and the other with the Eames vacuum driver brake. Both tender-trucks to be fitted with brakes, each brake company to have the option of selecting either of these engines for use in the trial of its brake.

"Competitors will be required to submit to all the tests that are decided upon by the committee."

The pamphlet referred to then gives very minute directions for making the tests. The Westinghouse Air Brake, the Eames Vacuum Brake, the Rote Brake, the American Driver Brake, and the Widdifield & Button—have entered for the contest. On the first day of the test the Rote Brake was withdrawn for thirty days, pending modifications.

There is said to be a large attendance of persons at Burlington who are interested in the trials.

The Old, Old Story.

ON the night of July 8th what might have been an appalling accident occured to the accommodation train which left New York for New Haven at 6.45 P. M. Between Westport and Green's Farms the train stopped because one of the eccentrics broke. Brakeman Mattoon was sent back to signal an approaching freight train. By the rules of the road he was required to go back with his lantern 1,200 yards, and then he would be called in to a distance of 900 yards from the train. He did not go more than half that distance, and a Harlem River freight train of twenty-seven cars came thundering on at a rapid rate. Every effort was made to stop the ponderous train after it saw Mattoon's signal, but in vain, and it struck the rear car of the standing passenger train with considerable violence. Most of the passengers had jumped from the cars, but there were a few remaining in them, and they were more or less shocked and injured. The engineer of the freight train, Samuel Close, was seriously injured, and the wreck caused by the collision was not cleared for three hours.

Freight Rates on Cotton Goods.

AT a meeting of many prominent dry goods merchants, held at the Merchants' Club on July 12th, resolutions were adopted in regard to the present freight tariff charged by the trunk lines on cotton goods manufactured in the east, which are carried as first-class freight. The eastern manufacturers and wholesale merchants regard this as unfair, especially as the railroads south and west of Chicago carry this class of goods to that city as fourth and fifth, and, in some cases, even as sixth-class freight, thus influencing the retailers to buy these goods in Chicago rather than in New York. The resolutions of the merchants provided as follows: "That a committee be appointed by the chair, whose duty it shall be to confer with the representatives of the trunk lines of railroad and again ask relief from this burdensome discrimination, and, in default of the desired relief, to take measures to secure the decision of the Supreme Court of the United States upon this important question." The following committee was appointed: Charles S. Smith, Cornelius N. Bliss, Joseph H. Weller, J. Howard Sweetser, Daniel Robinson and T. L. Greene.

Street-Car Consolidations.

IT is said that negotiations are still continuing between the Metropolitan and the Highland Street-Railway Companies in Boston looking to a consolidation. While nothing definite has as yet appeared officially, it is known that the arrangement will probably be upon the basis of the consolidation of the two into a new company, as the Highland will not be bought or leased. The Middlesex, running to Charlestown, Somerville, and Malden, is also negotiating with the South Boston Road for a consolidation. These two do a large share of the railroad-station travel. The Metropolitan and the Highland compete for business from the city proper to Roxbury or the Highland District.

PRESIDENT CLEVELAND vetoed the bill granting to railroads the right of way through the Indian Reservation in Northern Montana. The President says: "The bill now before me is much more general in its terms than those which have preceded it. * * * It ignores the right of the Indians to be consulted as to the disposition of their lands. * * * It invites a general invasion of the Indian country. * * * I am impressed with the belief that the bill under consideration does not sufficiently guard against an invasion of the rights, and a disturbance of the peace and quiet of the Indians on the reservation mentioned; nor am I satisfied that the legislation proposed is demanded by any exigency of the public welfare."

ON the 24th of June, the midnight express from Brussels to Antwerp had a narrow escape. When traveling at a high speed near the station of Vieux-Dieu, a driving-wheel tire broke, causing the engine to leave the line. Only the tender and guard's van followed, and the whole train was safely brought to a stand in a very short distance by the aid of the Westinghouse brake, and without injury to a single passenger.

AT Krupp's, in Essen, a railway truck has just been built with 16 axles. It was made for the special purpose of transporting by rail a cannon, which is 50 feet long and weighs nearly 136 tons, from Essen to Spezzia in Italy, by way of the St. Gothard tunnel. The truck is 76 feet long, and the axles are divided into groups of four, which easily adapt themselves to the curves of the road.

THE gross receipts of the twenty-two principal railways in the United Kingdom, for the week ended June 20, amounted, on 15,289½ miles, to £1,315,227, and for the corresponding period of 1885, on 15,120 miles, to £1,216,652, an increase of 169½ miles, or 1.1 per cent., and an increase of £98,575, or 8.1 per cent. the receipts including the Whit week traffic.

A FIRM of lumber dealers in Ellenville, N. Y., has taken a contract for supplying 30,000 ties for a new railroad to the iron mines in the Province of Arragon, Spain. The ties are to be first quality oak or chestnut timber, and to be delivered by boatload, via. the Delaware & Hudson Canal, at the New York docks.

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THE STANDARD HEIGHT OF DRAW-BARS FOR FREIGHT-CARS.

IT has been known for a long time that one of the most prolific causes of accidents in coupling cars is due to the varying height of their draw-bars. For that, and for other reasons, the Master Car-Builders' Association soon after it was organized took the matter up and attempted to establish a standard height for this important organ, it may be called, of freight-cars. In 1872, after a somewhat acrimonious discussion, the association recommended 2 feet 9 inches as the standard height, but, unfortunately, the resolution which was then adopted did not specify whether this height was to be measured when the car was loaded or empty, and, consequently, for years thereafter, some of the members built their cars with draw-bars of that height above the tops of the rails, when the cars were new and empty whereas others made allowance for the effect of the lading, and aimed to have the draw-bars 2 feet 9 inches above the rails when loaded. Still other companies established standards of their own and paid no attention to the action of the Master Car-Builders' Association. It seems probable, too, that there were among the members of that organization a considerable number who were ignorant of its action, or who never took the trouble to make their practice conform to what the association recommended.

At the annual convention of the Master Car-Builders' Association held last year, a committee was appointed "to submit detailed drawings of dead-blocks to be adopted as standards by the association." The main portion of this report is published on another page, and, as shown in a table, which forms a part of it, there is still a good deal of difference in the height of draw-bars of the principal railroads of the country, and a still greater variation in the height of dead-blocks. The committee therefore presented to the Master Car-Builders' Association the following question: "With the prevailing practice described, what is the best method to adopt to secure uniformity? Is it to adhere to the standard which was adopted fourteen years ago, or would the end aimed at be best secured by a modification of it to suit the existing practice of the principal lines?"

The Railroad Commissioners of the State of New York have recently been testing various automatic car-couplers, and their report will be found on another page. In this report they recommend the general adoption of the Master Car-Builders' standard height of draw-bars and dead-blocks. By referring to the table which forms part of the report of the committee on dead-blocks, it will be seen that the standard height of draw-bars of the New York Central, New York, Lake Erie and Western, Pennsylvania, and Baltimore and Ohio railroads is greater than

the standard of the Master Car-Builders' Association. The same thing is true, but, to a greater degree, of the height of dead-blocks. All of the four roads named have a considerable mileage in the State of Ohio. Now supposing that the Ohio Railroad Commissioners should take the matter up, what height of draw-bar are they likely to recommend? Would they probably ask the four principal lines in the State to abandon their practice and conform to that of lines which own a much smaller number of cars, and which have little or no mileage in Ohio? The next step to a recommendation of the commissioners s legislation compelling railroad companies to conform to what has been recommended. If the idea once gets fairly into the minds of legislators and the pub ic, that variation in the height of draw-bars and dead-blocks increases, materially, the danger of coupling cars, and interferes more or less with the interchange of traffic, it will probably not be long before there will be some compulsory legislation thereon, similar to the laws referring to automatic couplers, which so many of the State legislators have adopted. When this time comes, it will be of the utmost importance that there should be agreement among the principal railroads of the country regarding the standard height for both draw-bars and dead-blocks. It is to be regretted that all the railroad companies did not adopt the standards recommended years ago by the Master Car-Builders' Association, but the fact remains that they did not, and that the cars which conform to those standards are a minority. It is very much easier to raise cars up than it is to lower them. All that is required to increase the height of draw-bars is to block up the center-plates and side-bearings.

For these reasons the committee recommended an increase in the standard height of draw-bars and dead-blocks. This excited a very animated discussion at the convention, which resulted in a refusal to adopt the first two recommendations of the committee. This action indicated that the members who carried it through were either indifferent to the matter of uniformity, or else that they thought it would be more certain to be brought about by adhering to the action taken in 1872. With the great trunk lines united in favor of the committee's recommendations, they will be almost sure to be carried ultimately. If, in fact, when the question was decided, the representative members had voted in proportion to the number of cars owned, as they have the right to under the constitution, the result would probably have been different from what it was.

It should also be noticed that, at the same meeting a committee which was appointed to report on a standard height for draw-bars for passengers-cars, recommended that it be 34½ inches. This was referred to a letter ballot for decision. If adopted, there will then be three distinct standards for the height of draw-bars, 33 inches adopted by the car-builders in 1872; 35, the standard of the Pennslyvania system, the Baltimore and Ohio, and other main lines of road; and 34½, the standard for passenger-cars. If the recommendations of the committee, that the standard height be not more than 35 inches when the car is empty, nor less than 33 inches when it is loaded, had been adopted, it would have been accepted by the committee on the height of draw-bars for passenger-cars, and there then would have been one standard for all cars. As it is, the whole matter is in a confused condition, so that it is quite certain to force itself on the attention of the Car-Builders' Association again in the future, and ultimately it will be decided upon broader principles than those which seemed to animate some of the members who helped to defeat the recommendations of the committee, which, if adopted, would have established a standard to which all the railroads of the country could have made all their cars conform.

THE SEQUEL TO THE LATE STRIKES.

A CONSIDERABLE amount of space in the daily papers is now devoted to reports of the trials and convictions of persons for violation of the laws during some of the recent strikes. This is, no doubt, part of an evolutionary process through which the rights and duties of those who earn and those who pay wages will be more clearly defined. There can be no doubt of the fact, as remarked by Prof. Fawcett in a chapter on this subject, part of which is reprinted on another page, that "strikes are inseperably associated with our present economic system." They must be recognized, and means must be provided for deciding disputed points, just as we do in political questions and contests. Until quite recently many employers took the ground that they would not "recognize" a trade union, or a representative committee of their employés. Most employers now see that such a position is unfair, and therefore untenable, and the right of workingmen of being heard through a representative committee, is now very generally recognized; and that fact is a distinct advance in what may be called the jurisprudence of the labor question.

But, on the other hand, the workingmen, through their unions, have repeatedly demanded the right of prescribing whether certain persons shall or shall not be permitted to work for their employers, and have demanded that members of their unions should not be discharged without the sanction of their organizations. They have also claimed and exercised the right of conspiring to injure and destroy the business of those who would not do or leave undone what the unions demanded. Now, if these views were distinctly formulated, and if there was any real danger that

they would displace our present system of law, it would at once create a revolution, and thousands would be ready to shoulder their muskets to resist them. The astonishing thing is, that the workingmen do not seem to see this. Doubtless, the recent trials and convictions of those guilty of illegal acts, the clear statements of law and equity in such cases by the judges, will do much to give the members of trades unions a clearer apprehension of their rights and duties; and it may confidently be anticipated that they will soon abandon the right to boycott, and of prescribing that certain person shall or shall not be employed. When this is done, and when employers distinctly recognize the right of those who work for them of belonging to trades unions, without prejudicing the one against the other, and are willing to give a fair hearing to any committee of their own employés, then we may look for the advent of more of what some one has called "sweet reasonableness" into the councils of employers and employés.

STIRRING UP STRIFE.

IT is said in a certain old book, which was more venerated some time ago than it seems to be now, that the peace-makers are blessed. It is to be feared that this benediction will not fall upon the heads of the editors of the *National Car and Locomotive Builder*, if they persist in their effort to stir up strife in an association which that publication might be expected to shield with a mantle of charity. Instead of doing that, it publishes an invidious and anonymous letter, and then comments thereon in a manner quite certain to stir up animosity between "two distinct elements in the association." One of the objects of the association, according to its constitution, is "to provide an organization through which the members, and the companies they represent, may *agree* upon such joint action as may be required to bring about uniformity and inter-changeability in the parts of railroad cars." Does our cotemporary honestly think that he assists "*agreement*" when he emphasizes the fact that, "there are two distinct elements in the association," and intimates that the one is "sanguine, opinionated, overweening and confident, * * added to a rattling volubility * * * with a plentiful lack of safe conservatism which comes from large experience * * * with a pretty clearly revealed purpose to make the association subservient to the interests of a great leading road and its affiliated lines?"

The most important and, at the same time, often the most difficult end to be attained by the meetings of the car-builders' is to secure *agreement*. Our cotemporary knows, or should know, this. It has found fault repeatedly because the association has not established standards as rapidly as it should. In substance, then, it has said to the car-builders, "you should meet, and reason, and agree together, but some of you are opinionated, overweening and filled with rattling volubility, and trying to shape the action of the association upon controverted points so as to favor the ascendency of a particular interest." Verily, this is pouring vitriol and not oil upon the troubled waters.

EDITORIAL NOTES.

THE reports of the progress of the trials of automatic brakes, on the Chicago, Burlington and Quincy Railroad, at Burlington, which have thus far reached us, are very meager, but the descriptions of the arrangements for the trials which have been published, indicate that they are very complete, and that they have been devised with a very thorough knowledge of what is essential in making such experiments. Great credit is due to the committee, and especially to its chairman, Mr. GODFREY W. RHODES, superintendent of machinery, of the Chicago, Burlington and Quincy Railroad, who made all the arrangements for carrying out this elaborate series of experiments. The Chicago, Burlington and Quincy Railroad has set an example, by furnishing the facilities for making these tests, which other roads might imitate with credit to themselves, and advantage to the whole railroad system of the country and to the public generally.

* * *

FAST hotel trains are rapidly becoming popular. All the great lines from this city now run them west. The New York Central has lately put in operation a system which wins high praise from its patrons. When the vast convenience of such a plan is considered, the price at which the luxury is supplied seems little less than miraculous economy.

* * *

THERE seems to be a present lull in the war of rate-cutting—and a very good thing too. A few passengers who at the time take advantage of cut-rates may benefit thereby; but it is otherwise a suicidal policy. May peace be permanent!

Specifications for Railroad and Canal Construction. By John H. Yates, C. E. Chicago: *The Railway Age* Publishing Company.

There is a class of books which always lead some readers to wonder why the authors, after making them as good as they are, did not take more trouble and make them much better. The book whose title has been given is one of this class. It makes no pretense to originality, it is true, but the author might at least have aimed at more completeness. Thus, under the head of railroad bridges, we find specifications for pile and trestle bridges, and nothing more; and for canal bridges we have information concerning Whipple's patent iron-arch truss! The wonder is where the writer exhumed such relics of antiquity. To sum up, the book is simply technical hash, which is not very pleasing to the appetite, but nevertheless contains some nutrition.

Street-Railways.

American Street-Railway Association.

President.—Julius S. Walsh, President Citizens' Railway Company, St. Louis, Mo.

First Vice-President.—William White, President Dry Dock, East Broadway and Battery Railroad Company, New York City.

Second Vice-President. C. H. Holmes, President Chicago City Railway Company, Chicago, Ill.

Third Vice-President.—Samuel Little, Treasurer Highland Street-Railway Company, Boston, Mass.

Secretary and Treasurer.—William J. Richardson, Secretary Atlantic Avenue Railroad Company, Brooklyn, N. Y.

Office of the Association, cor. Atlantic and Third Avenues, Brooklyn, N.Y.

The Fifth Annual Convention of the Association will meet in Cincinnati, O., on Wednesday, October 20th, 1886.

ELECTRICITY AS A MOTIVE-POWER ON RAILROADS.

AT the last meeting of the American Street-Railway Association, a committee made a report on "The Progress of Electricity as a Motive Power," the conclusions of which are that "the committee consider the application of electricity to the propulsion of street-cars as entirely feasible. The seven electric railways in Europe, besides the tests in this country, prove this to be true. It is now narrowed down simply to a question of dollars and cents, or comparative economy with horses, cable power, etc."

The "question" to which the committee say this whole subject is narrowed down, it must be admitted, is a rather important one. In fact, it is of so much importance, that until it is answered satisfactorily, there is no hope that electricity will displace horse, steam, or cable power. The reports of recent experiments in this direction which have been made public, while they are very incomplete, are, nevertheless, not at all assuring or promising that electricity will speedily come into use as a motive power for street or any other railroads.

In the discussion which followed the reading of the report referred to, inquiry was made of the working of the Bentley-Knight system of electrical motors which was tried on the East Cleveland road. Mr. HERRICK, of Cleveland, reported that "it has not proved such a success as to satisfy us that we can wisely adopt it. It answered the purpose at first, and the cars seemed to run very well. Without going largely into details, I can say this, tha it seemed to be controlled well in starting and stopping; that there was not much difficulty in regard to that part of its work, but the speed could not be regulated very well. * * * We had it there something over a year. The owners made every effort to improve it; and finally it has been given up without any further efforts in the line of improvement."

During the same discussion a letter from Mr. T. C. ROBBINS, general manager of the Baltimore Union Passenger Railway, on which the Daft electric system of motors is in use, was read. In this letter Mr. ROBBINS says: "The electric power necessary to run ordinary street-cars can be furnished by use of steam to generate the electricity for one-half the cost of horse power." * * In conclusion he says, "while we have not had the motors in operation long enough to determine the percentage of cost, as compared to horse or mule power, I am satisfied that it will be in favor of electricity, especially on car-lines of ten cars and upwards." This sounds very much like saying that "electricity is cheaper, but we don't know what it costs."

Of Mr. EDISON'S celebrated experiment at Menlo Park, Mr. RICHARDSON, of Brooklyn, said: "The motive power was supplied by a very expensive establishment, so far as the steam engine is concerned, some of us thinking that it ought to furnish the power to move a hundred cars instead of only one; and the whole effect of that experiment, in my mind, was that it indicated far too great an expense for it to be considered in the light of a successful experiment to be applied to an ordinary city street-railroad. The power was there and the car moved rapidly, but I think that, in the judgment of all present, there was nothing shown to us as to its practicability in the most important sense of that question: Will it pay?"

In an address, delivered in Melbourne, Australia, by Mr. HALLIDIE, of San Francisco, the originator of the cable system of railroads in the latter city, he said that one of the directors of the Compagnie Générale des Omnibus in Paris had said that they had experimented on thirteen different methods of dispensing with horses; that electricity was the last and the most expensive experiment, and that, after all, they had returned to horses, and determined to make no further experiments.

On the elevated railroad in New York, three different parties have been experimenting with electrical motors with very doubtful success. Two of them have abandoned the experiments, and the third is continuing them in a very spasmodic way, with apparently very little promise of a favorable result.

For some reason, the testimony to show that electricity is an economical medium of applying power on railroads is very slow in making its appearance. It would, of course, be great folly for any one to assert, at the present time, that the use of electricity as a motive power will not ultimately be made as economical as horses, cables or locomotives; but at present there is obviously a gap which inventors have not been able to bridge over. It is not the purpose of this article to discourage investigation and experiment in this direction, but, if possible, to restrain inventors of electrical motors from making extravagant claims, and lead them to be more careful in collecting

and stating the proof of the success of their inventions; and to recommend caution in accepting and believing their "claims."

THE gay and elusive Mr. SHARP still appears to be invulnerable, so far courts and prosecutions as yet concern him. The daily press continues a laudable outcry and effort to enroll him as a member of the ignoble army of martyrs, but judging from the present singularly apathetic temper of the powers that be he still has a long lease of freedom.

* * *

STREET-RAILWAY labor in this city is at present in a marvelously peaceful and quiet condition. Even the smoke of former battles appears to be blown far away and out of sight, while quiet reigns. If labor only knew it, the present is the condition best conducive to its interests; but it is hard of conviction.

* * *

THE Broadway surface road controversy is still unsettled. The receivers and their opponents keep up the fight, and probably will as long as ammunition lasts. A speedily emptied magazine would be a blessing to the city.

MOTIVE POWER.

BY MARVIN C. WILLIAMS.

[Written for the AMERICAN RAILROAD JOURNAL.]

IN view of the universal and extensive experiments which have of late years been made, it seems not a little singular that, so far as motive power is concerned, street-railways are practically where they were at their inception.

It is true that in the nature of the case the room for improvement is somewhat limited. It is not as with the steam lines, where there is an almost unlimited opportunity for the application of invention and resource, guided by experience. The street-railway was, at its birth, almost full-grown; still, in certain features, the system has undergone the improvement and perfecting which time brings about, and save in one direction, is about fully developed, and this is motive power, for while it is true that there are surface-roads in cities which do not use horse traction, the majority of cases wherein it is employed is so vast that the minority can only rank as experiments, and not improvements.

To those familiar with the bent of inventive genius, and under whose observation patents constantly are passing, it is a matter for astonishment that so little practical has survived the vast amount of labor and ingenuity spent on solving the problem of a satisfactory street-railway motive power. The cable and dummy-engine have, of course, received the bulk of attention from inventors, and numberless contrivances and devices have been brought into play in the endeavor to solve the problem, with necessarily very great expense. In addition to these two principal means of propulsion outside of horse-flesh, there have been many other methods devised and experimented with, besides many modifications of the two first mentioned. So far as the dummy-engine is concerned, at least in populous cities, the system seems conceded to be a failure; for while a few years since the dummy was by no means an uncommon sight in much-traveled streets, it has now utterly disappeared. The principal objection to its employment as a motor for street-cars was the apparent impossibility of ever teaching the ordinary street horse to view it with equanimity, and its continued use was attended with so many accidents from this cause, and being a constant menace to life and limb, it was by common consent relegated to obscurity.

It is also doubtful whether, aside from the above cogent reason, it could be considered a success, judged by either a financial or mechanical standard. Opinions and reports on the former point differ widely, but it is nowhere plainly shown that its adoption would be attended by great saving, while from the latter there are serious drawbacks. In our Northern cities it is specially desirable that if a car leaves the track the motive power is not compelled to follow it. If a horse-drawn car becomes derailed by snow, the power, being entirely independent, is able to exert itself in any desired direction, and it is thus not difficult to remedy the mishap. Such, however, is not the case with the steam street-car. Derailed it is, so far as concerns the original power, a hopeless cripple, and must rely on outside aid.

So far as this difficulty is concerned, the cable seems to present less that is objectionable than any other substitute for horses; but there is the trouble of keeping the slot clear, with many other vexatious disadvantages; but so far the system seems the best known, and, like almost everything, is susceptible of great improvement.

Taken all around, however, the horse-car *per se* would appear to give the best general results, but it is very evident that in the solution of the problem a wide field is open to inventors, and he who finds the answer will reap a rich reward.

Cable Railways in Massachusetts.

MR. LILLEY, of Middlesex, for the committe on street-railways, reported the following bill in the House June 21st:

SEC. 1. Any street-railway company which is now, or may hereafter be formed, may, with the approval of the board of aldermen of cities and selectmen of towns, establish and use the cable system of motive power, so called, for the purpose of operating its road, and may, with the approval and under the direction of the board of aldermen of cities and selectmen of towns, make such underground or surface alterations in the streets or ways through such railway passes as may be necessary to the purpose, subject, however, to the provisions of chapter 113 of the Public Statutes, so far as the same are applicable.

SEC. 2. Any street-railway company, operated by cable motive power, so called, which enters upon and uses the tracks of another in the manner now provided by law may, with the approval of the board of railroad commissioners, use the cable motive power of such other company, and for such use shall pay such compensation as the board of railway commissioners shall from time to time determine.

The manner and time of payment of such compensation to be fixed by the commissioners, after hearing, in the manner provided by chapter 112 of the Public Statutes for compensation for the use of motive power by connecting railroads.

SEC. 3. Any street-railway company for the purpose of carrying into effect the provisions of this act may increase its capital stock in the manner provided by sections 58, 59 and 60 of chapter 112 of the Public Statutes, for increase of capital stock of railroads.

SEC. 4. The provisions of chapter 113 of the Public Statutes relating to the formation of street-railway companies shall, subject to the provisions of this act, apply so far as possible to street-railway companies in whole or part by the cable system of motive power, so called, the same as though such street-railway companies were operated by animal power.

SEC. 5. This act shall take effect upon its passage.—*Street-Railway Journal.*

Cable Tramways in Melbourne.

THE citizens of Melbourne, Australia, having found themselves in need of means of inter-communication, both as regards the city and suburbs, the authorities decided upon the adoption of cable tramways. They had precedents in the United States of America, in Dunedin, New Zealand, and in our own tramway line at Highgate. They are now laying down an important series of lines in Melbourne on the cable system, involving an expenditure of of about a million and a half sterling. The wire cables of these lines are being manufactured at the works of Messrs. Bullivant & Co., Blackwall. There are two ropes, one being 4,340 fathoms, or nearly five miles, and the other 2,459 fathoms, or over two and three-quarter miles in length, and weighing, respectively, about 24 tons and 16 tons each. They are composed of a hemp core enclosed spirally by six wire strands, each strand consisting of 31 wires. Each rope is 3¼ inches in circumference, and has the high breaking strain of 150 tons per square inch of sectional area.—*London Times.*

A Cable Road for Third Avenue, New York.

THE Third Avenue (surface) Railroad Company, of New York, proposes to change their horse-car line into a cable road. It will be divided into three sections, one extending from the depot at Sixty-fifth street to Harlem; another from the depot to Sixth street, and a third from Sixth street to the terminus of the road in front of the Post Office. The road is a little over eight miles long. The entire system of cables will be duplicated, so that in the event of one of the cables breaking, or any part of the machinery giving out, a second one can immediately be set in motion.

A New Terminus for the Long Island Railroad at South Ferry.

IT may be remembered by persons who are uncomfortably near or uncomfortably far from fifty, that a good many years ago the Long Island Railroad had one of its termini at South Ferry in Brooklyn, which was approached by a tunnel in Atlantic avenue. This for some reason was closed, and, no doubt, the Long Island Railroad Company has often had occasion to regret it. It is now said that Mr. Corbin proposes to build an elevated railroad from the foot Atlantic avenue, Brooklyn, to East New York, *if* the Brooklyn common council will give its consent. Perhaps only Mr. Corbin knows how formidable an obstacle is represented by that "if," but it would, undoubtedly, be a great advantage to his road, and give very much needed facilities to those who do business in New York and who want to live on Long Island, of whom there are, doubtless, a good many.

STREET-RAILWAY NEWS.

ALABAMA.

THE Birmingham & Pratt Mines Street-Railway Company claims the exclusive right to build a line to Elyton; and has so notified the Birmingham Street-Railway Company which has been proposing to construct a line over the same route.

ARKANSAS.

G. W. Baxter, of Hot Springs, Ark., proposes to build an inclined plane railroad at Eureka Springs to the top of West Mountain, where he intends to erect an observatory and lay out pleasure grounds.

COLORADO.

The Denver Electric Street-Railway is progressing, and the track-laying is going ahead.

The Denver Tramway Company has been incorporated. Capital stock, $500,000. Rodney Curtis and others, incorporators.

CONNECTICUT.

The capital for the proposed horse railroad in Meriden has nearly all been subscribed.

DAKOTA.

A street railroad is talked of for Sioux Falls; the scheme will probably take a definite shape this year.

DISTRICT OF COLUMBIA.

The Washington Cable Railway Company is to be incorporated. It is expected that it will meet with considerable opposition from the horse-car lines.

FLORIDA.

The City Council of Palatka has granted the right of way for a street-railroad.

At Tampa the street-cars are hauled by steam engines.

GEORGIA.

A new street railroad is talked of for Covington. Particulars may be obtained from W. C. Clark & Co.

ILLINOIS.

At Bloomington a street-car line out to the cemetery is desired.

The North Chicago Street-Railroad Company has been authorized to operate its line on certain streets, on the cable system; the company will run cable cars through the La Salle-street tunnel. It is charged in the daily papers that there has been considerable bribery in obtaining

the franchise, which has lately been revised by the Mayor to give greater benefit to the city. Philadelphia capitalists are interested.

Princeton people want a street-railway from the Court House to the railroad depot.

KENTUCKY.

The Fourth-Avenue Park Railway Co. has been organized at Louisville.

MASSACHUSETTS.

A bill has been reported to incorporate the Newton Street-Railway Co.

The Hoosac Valley Street-Railway was not abandoned after all, and is now under construction. The objection was not to the line, but to the manner in which it was originally designed to be carried out. The locomotives have been delivered at North Adams and are reported to be similar to those in use on the elevated railroads.

The Plymouth & Kingston Street-Railway Co. has a capital stock of $20,000. D. Thurber is President.

The Winthrop Electric Railway Company has been incorporated with a capital of $30,000. Erastus H. Doolittle, J. A. Enos, and others are interested.

The new street-railway company at Worcester has sold out to the old company, and will consolidate with it, when permission is obtained from the Legislature.

MICHIGAN.

On the Van Depoele Electric Railway between Detroit and Dearborn, a distance of three miles, a single train will be run, consisting of six large street-cars, at a speed of 15 to 20 miles per hour.

The Highland Park Railway Company has been incorporated at Detroit. Capital $50,000. Frank E. Snow and others.

At Grand Rapids the city authorities have passed a resolution declaring a street-railroad on certain streets to be a public necessity, and providing that if the present company does not commence within a stated time, other parties shall be permitted to do the work.

MINNESOTA.

The Mankato Street-Railway Company has filed articles of incorporation. W. W. Farr, S. Lamm, and others, all of that city. Capital, $50,000.

The Stillwater Street-Railway Company has been incorporated with a capital stock of $100,000. The other company has withdrawn its proposition.

MISSOURI.

At St. Louis, Thos. O'Reilly has applied for a franchise to build an electric elevated railroad four and a half miles long. The line is to be constructed in the middle of the street.

NEW JERSEY.

A New York syndicate proposes to build a street-railway in Plainfield.

NEW YORK.

An experimental trial of a new electric motor was made recently on the 34th street branch of the Third Avenue Elevated Railroad.

Mr. Richardson, President of the Atlantic Avenue Railroad Co. (Brooklyn), has applied to the Common Council for authority to substitute cable for horse traction from Fulton Ferry to the Prospect Park and Coney Island Railroad at the city line.

The Canandaigua Street-Railroad Company, capital stock $30,000, has been incorporated by F. Chamberlain and others.

The Jamestown Street-Railroad Company recently had a switch torn up by order of the City Council; subsequently, however, the company obtained permission to relay the same switch.

At Randolph a new street-railway is in contemplation. T. L. Higgins, of Fredonia, can furnish information, plans, etc.

The Seneca Falls and Waterloo Railroad Co's. extension to the Lake is progressing rapidly. A hotel is to be built at the Lake.

The Woodlawn and Butternut Street-Railroad Co. of Syracuse, has been incorporated by Peter Kapesser and others. Capital $30,000.

PENNSYLVANIA.

The Traction Company, of Philadelphia, has introduced an electrical alarm system on its Market street line. The wires are laid in the conduit and can be operated from any manhole. It is to be used in the event of there being any accident to the cars.

The Union Electric Company has been operating its experimental car on Ridge avenue, Philadelphia. A conduit 4½ inches by 9 inches contains the conductors, on which runs a traveler connecting with the motor on the car by wires. The comparative cost per day, including salaries, of horse and electric cars are estimated at $4.74 and $1.84 respectively.

The Brownsville Avenue Street-Railroad Company of Pittsburgh, will build a line from Carson street to the city line and thence to Knoxville. Horses or electric motors will be employed.

The East End and Wilkinsburg Electric Railway, in Pittsburgh, is approaching completion.

SOUTH CAROLINA.

A street-railway is to be built in Columbia. A company has been incorporated by T. D. Gillespie and others, with a capital of $50,000.

TEXAS.

The Alvarado Street-Railroad Company has commenced work on its line.

The Gulf City Street-Railroad Company of Galveston, has been refused an extension of time to complete its connections.

The Waco Street-Railway Company will extend its line two miles.

MISCELLANEOUS.

The Assembly has passed the bill authorizing any horse street-railroad company to change its line to the cable system on obtaining the consent of one-half the property owners along the route.

In the United States there are 233 towns and cities which have horse-railroads; the aggregate length of lines is 3,340 miles, and they employ 84,577 horses and 16,843 cars.

Manufactures.

THE ROGERS LOCOMOTIVE AND MACHINE WORKS.

THIS company has recently had a new descriptive catalogue prepared, which contains a very interesting account of the origin of this establishment, and of what may be called the mechanical evolution of the locomotive in these works. The following extracts are made from advanced sheets. Other parts of this interesting history will be published in succeeding numbers of the JOURNAL:

CHAPTER I.

The Rogers Locomotive and Machine Works were founded by Thomas Rogers, who was born March 16th, 1792, in the town of Groton in New London County, Connecticut. He died in New York City, April 19th, 1856. He served in the war of 1812, and was a lineal descendant of Thomas Rogers, one of the Pilgrim Fathers, who came over to this country from England in the Mayflower. At the age of sixteen he was apprenticed to learn the trade of a house carpenter, and in the summer of 1812 he removed to Paterson, N. J., then a small village, which at that time was very prosperous on account of the demand for American manufactures brought about by the war with Great Britain.

At this time he was employed as a journeyman carpenter, and was noted for his constant application to business, good judgment, and force of character. A few years afterward, Captain Ward, who had been traveling in Europe, where he had seen the power-loom in operation, came to Paterson for the purpose of introducing the manufacture of cotton duck. Mr. Rogers was employed to make the patterns for these looms. He very soon understood their construction and recognized their value, and bought from Captain Ward the patent-right for making them.

In 1819, he associated himself with John Clark, Jr., under the firm name of Clark & Rogers. They commenced work in the basement story of the Beaver Mill, a building which at an early day had been put up by Mr. Clark's father. Shortly afterwards, Mr. Rogers visited Mexico, where he received large orders for looms, etc. In 1820 the firm moved into the little Beaver Mill, and in the following year took into partnership Abraham Godwin, Jr., and the firm name was then changed to Godwin, Rogers & Co. They then commenced spinning cotton and building machinery for that and other purposes.

In 1822, finding their accommodations too limited, they leased Collett's Mill and moved into it. Their business continued to increase, the number of persons employed being sometimes as high as 200. The establishment continued to prosper until the summer of 1831. In the latter part of June of that year Mr. Rogers withdrew, and took with him $38,000 as his share of the profits of the firm.

He then took a mill-site on the upper raceway in Paterson, and immediately commenced the erection of the "Jefferson Works," which were finished and put in operation before the close of the following year. The location and building of the "Jefferson Works" was literally an encroachment on the forest. On the upper race no factories had been put up, except two little cotton mills and a small machine shop, the latter owned by Messrs. Paul & Beggs. Between Spruce and Mill streets, all was swamp covered with pines.

It was the intention of Mr. Rogers to devote the lower stories of the "Jefferson Works" to building machinery, and the upper stories to spinning cotton. The latter was, however, never commenced, as the demand for machinery increased so fast that the whole of the new building was devoted to that branch of the business.

In the early part of 1832, he associated with himself Messrs. Morris Ketchum and Jasper Grosvenor, of New York, the name of the firm being Rogers, Ketchum & Grosvenor.

In that year the railroad from Jersey City to Paterson was approaching completion, and the iron work for the bridges over the Passaic and Hackensack rivers had been made by Mr. Rogers. An order was also executed for one hundred sets of wheels and axles for the South Carolina Railroad, of which Mr. Horatio Allen was the chief engineer. A short time before Mr. Allen had visited England to get information about the use of locomotives on railroads, and at the time he ordered the work for the South Carolina Railroad he recommended Mr. Rogers to undertake the construction of locomotives.

In the following letter, written more than fifty years after the event, Mr. Allen describes his interview with Mr. Rogers:

"SOUTH ORANGE, N. J., December 31st, 1884.

"DEAR SIR:—The earliest railroad work in this country was done by the West Point Foundry Association, to which was entrusted the order for railroad wheels for the South Carolina Company, and other work for that company.

"Knowing that the era that had opened would require works specially appropriate to the construction of the rolling-stock up to the locomotives, I obtained authority in the spring of 1830 from the South Carolina Railroad Company to seek the works which in position, instrumentalities, and preparedness, were in condition to undertake and were willing to undertake what was wanted.

"The result of inquiries to the end in view led me to call on Rogers, Ketchum & Grosvenor, a firm then engaged in the manufacture of machinery for cotton and woolen mills, whose works were at Paterson, N. J.

"At these works I called and asked an interview with Mr. Rogers, the partner having charge of all the mechanical operations of the firm. It was without any letter of introduction or any personal knowledge of each other. My subject was my introduction, and Mr. Rogers very soon led me to know that I had come to the right place and to the right man.

"At the close of an hour's conversation Mr. Rogers expressed his readiness to enter the new field, and to undertake any orders that were entrusted to their firm. The future of 'The Rogers Locomotive Works' was determined at that hour's conversation.

"The personal and business relations which followed this interview, continued for many years, and were to me of the most satisfactory character."

"Yours truly, HORATIO ALLEN."

CHAPTER II.

THE EARLY HISTORY OF RAILROADS IN THIS COUNTRY.

In 1833 railroads were already attracting a great deal of attention in this country. The opening of the Erie Canal for commercial purposes in 1826, and the consequent diversion of traffic from other seaboard cities to New York, led the people of Philadelphia, Baltimore, Boston

and Charleston to seek for means by which their lost trade could be recovered. Investigation and accurate surveys soon showed the impracticability of constructing canals from Baltimore to the Ohio river, or from Boston to the Hudson. In the meanwhile information concerning the successful use of steam-power on the Stockton and Darlington Railroad in England, which was opened in 1825, had reached this country, and the public had received the reports of the celebrated experiments with locomotives which were made on the Liverpool and Manchester Railway in 1829. As Mr. Charles Francis Adams, Jr., has expressed it: *

"America suffered from too few roads; England from too much traffic. Both were restlessly casting about for some form of relief. Accordingly all through the time during which Stephenson was fighting the battle of the locomotive, America, as if in anticipation of his victory, was building railroads....

"The country, therefore, was not only ripe to accept the results of the Rainhill contest, but it was anticipating them with eager hope."

After the experiments referred to had been made, full reports giving in detail their results were published in this country, committees of inquiry were sent to England to get information and report on the railroads of that country, and a railroad mania began to pervade the land.

The first railroad which was built in the United States was a short line of about three miles from the Quincy granite quarries to the Neponset river, † for the transportation of granite for the Bunker Hill monument. This was merely a tram road and was operated by horse-power and stationary engines, and was built in 1826. As Mr. Adams says:

"Properly speaking, however, this was never—or at least, never until the year 1871—a railroad at all. It was nothing but a specimen of what had been almost from time immemorial in common use in England, under the name of 'tramways.'"

A similar work was constructed at about the same time for the transportation of coal from the pit's mouth to the Lehigh Valley Canal near Mauch Chunk, Pa.

In the latter part of 1827, the Delaware and Hudson Canal Company put the Carbondale Railroad under construction. This road extends from the head of the Delaware and Hudson canal at Honesdale, Pa., to the coal mines belonging to the Delaware and Hudson Canal Company at Carbondale, a distance of about sixteen miles. This line was opened, probably, in 1829, and was operated partly by stationary engines, and partly by horses. The line is noted chiefly for being the one on which a locomotive was first used in this country. This was the "Stourbridge Lion," which was built in England under the direction of Horatio Allen, then an assistant engineer on this line. It was tried at Honesdale, Pa., in August, 1829.

According to "Poor's Railroad Manual for 1876 and 1877": "It was not until 1828, that the construction of a railroad was undertaken, for the transportation both of freight and passengers, on anything like a comprehensive scale. The construction of the Erie Canal had cut off the trade which Philadelphia and Baltimore had hitherto received from the west; and as the project of a canal from the city of Baltimore to the Ohio was regarded by many as impracticable, the merchants of that city, in 1827, procured the charter of the present Baltimore and Ohio Railroad. On the 4th of July, 1828, the construction of the railroad was begun, the first act being performed by the venerable Charles Carroll, of Carrollton, the only then surviving signer of the Declaration of Independence. At the close of the ceremony of breaking ground, Mr. Carroll said:

"'I consider this among the most important acts of my life, second only to that of signing the Declaration of Independence, if even second to that.'

"In the fall of 1829, the laying of the rails within the city of Baltimore was begun. On the 22d of May, 1830, the first section of fifteen miles, to Ellicott's Mills, was opened.

"The next important railroad was the South Carolina,* begun in 1830, and opened for traffic in 1833 for its whole length (135 miles). At that time, it was the longest continuous line of railroad in the world. The construction of the Mohawk and Hudson Railroad, now a part of the New York Central, was begun in 1830. It was opened (17 miles) in 1831. The Saratoga and Schenectady Railroad (21½ miles) was opened in the following year; the Paterson and Hudson River Railroad was chartered in January, 1831, construction on it was commenced in 1832, and it was opened in 1834; the Cayuga and Susquehanna (34 miles), connecting the Susquehanna river with the Cayuga Lake, was opened in 1834; and the Rensselaer and Saratoga (25 miles) in 1835. In New Jersey, that portion of the Camden and Amboy extending from Bordentown to Hightstown (14 miles) was opened on the 22d of December, 1830; and between Hightstown and South Amboy (47½ miles) in 1834. In Pennsylvania, a considerable extent of line for the transportation of coal had been constructed previous to 1835. In 1834, the Philadelphia and Columbia (82 miles) and the Portage Railroad (36 miles), both forming a part of the system of public works undertaken by the State of Pennsylvania, were opened. The completion of these gave that State a continuous line, made up of canal and railroad, from Philadelphia to the Ohio river at Pittsburgh. The total mileage of railroad constructed in the State of New York up to, and including, 1835, was 265 miles, or more than one-quarter of the whole extent of line then in use in the United States. In 1833, the Baltimore and Ohio Railroad was extended as far west as Harper's Ferry (81 miles). In the same year the Washington branch (30 miles) was also completed. In Massachusetts, in 1835, the Boston and Worcester Railroad (44 miles), the Boston and Providence (41 miles), and the Boston and Lowell (26 miles) were all opened for business. The total mileage in operation in all the States at the close of that year was 1,098 miles."

The preceding sketch of the early history of railroads in this country, is given to show the extent of railroad construction at the time that Mr. Rogers determined to undertake the manufacture of locomotives.

* See "Railroads: their Origin and Problems."

† It has recently been stated that as early as 1809 an experimental railroad track, 180 feet in length, was laid in Delaware County, Pa., and that in the same year a road about a mile long was constructed from stone quarries on Crum Creek to a "landing" on Ridley Creek in the same county and State. The evidence upon which this statement is based has not been made public.

* The original charter of the South Carolina Railroad was granted December 19th, 1827. This was not satisfactory to some of the citizens of Charleston, and a new bill was reported to the legislature on the 22d of January, 1828, and passed on the 29th of the same month. The stockholders organized as a company on the 12th of May, 1828.

CHAPTER III.

THE EARLY HISTORY OF LOCOMOTIVES IN THIS COUNTRY.

In the latter part of the year 1827, the Delaware and Hudson Canal Company decided to have built in England three locomotives, for their line of railroad from Honesdale to Carbondale. This action was taken on the report of the chief engineer of the road, Mr. John B. Jervis; and Mr. Horatio Allen, then a resident engineer on the line, was deputized to go to England and have the engines built on plans to be decided by him when in England. He arrived there early in 1828, and ordered one engine from Foster Rastrick & Co., of Stourbridge. This was the "Stourbridge Lion" (Fig. 2). Two other engines were ordered from Stephenson & Co., Newcastle.

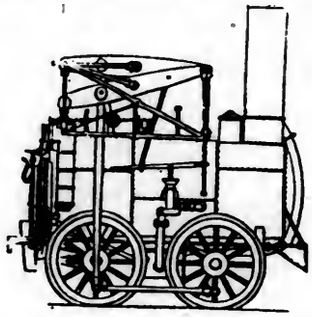

Fig. 2.

In a pamphlet, with the title "The Railroad Era," written by Mr. Allen in 1884, he says:

"The two locomotives from Stephenson that were in New York early in the year 1829, and therefore prior to the trial of the locomotive 'Rocket' in October of that year, were identical in boiler, engines, plan and appurtenances with the 'Rocket' (Fig. 3); and if one of the two engines in hand ready to be sent had been the one used on August 9th, 1829, the performance of the 'Rocket' in England would have been anticipated in this country.

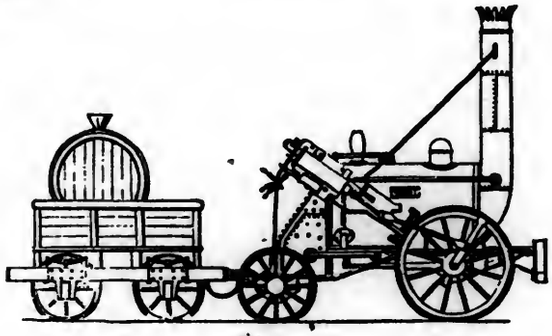

Fig. 3.

"The three locomotives were received in New York in the winter of 1828 and 1829. One of each kind was set up, with the wheels *not* in contact with the ground, and steam being raised, every operation of the locomotive was fully presented, except that of onward motion."

None of these engines were sent to the road for which they were intended, until the following spring. The "Stourbridge Lion," so far as is known, was the only one which was ever placed on the road. It was not tried until August 9th, 1829, and was then run by Horatio Allen, who has the honor of being the first person who ever ran a locomotive in America.

This engine, it was said, was too heavy for the road, and was used only a short time. It is a singular fact that it is not now (1886) known what became of the two engines built by Stephenson & Co., and which were in every essential similar to the celebrated "Rocket."

In August, 1830, Peter Cooper tried his "model of experimental locomotive engine" (represented by Fig. 4) on the Baltimore and Ohio Railroad. This engine had but one working cylinder of 3¼ inches diameter, and 14½ inches stroke of piston. The engine was tried on August

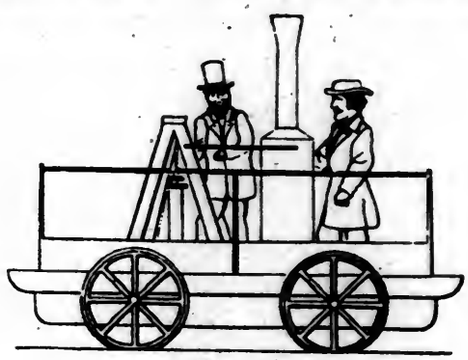

Fig. 4.

28th, 1830. In the same year, the South Carolina Railroad Company contracted with Mr. E. L. Miller to build a locomotive, which was named the "Best Friend," for the South Carolina Railroad Company. This engine (shown by Fig. 5) was put into service in November, 1830, and was

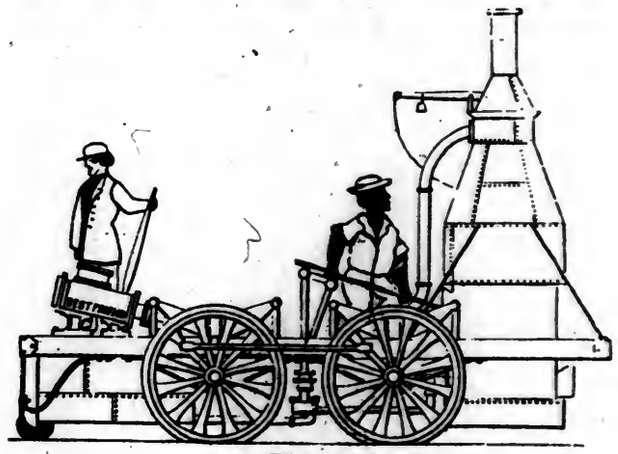

Fig. 5.

the first locomotive ever built in America for actual service upon a railroad.

A locomotive called "The South Carolina" (Fig. 6), designed by Horatio Allen, was built for the South Carolina Railroad by the West Point Foundry Association, in the year 1831. The boiler had its fire-box in the middle,

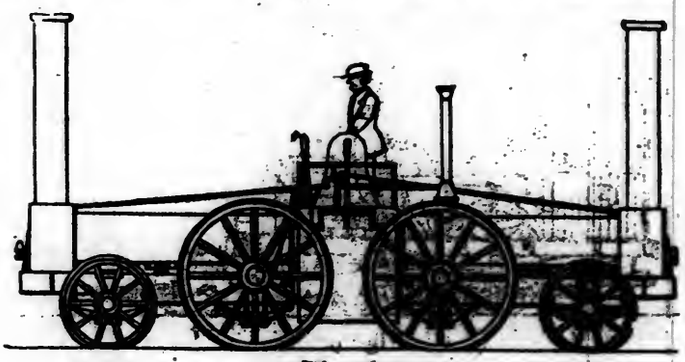

Fig. 6.

with a pair of barrels (four in all) extending each way, with a chimney at each end. The engine had eight wheels, arranged in two trucks, one pair of driving-wheels, and one pair of leading wheels forming a truck. Each truck had one cylinder, which was in the middle of the engine.

and attached to the smoke-box. The driving axle had a crank in the middle to which the connecting rod was attached by a ball-joint. The trucks were connected to the engine by king-bolts in the usual way.

The "De Witt Clinton" (Fig. 7) was the third locomotive built by the West Point Foundry Association. It was made for the Mohawk and Hudson Railroad, and

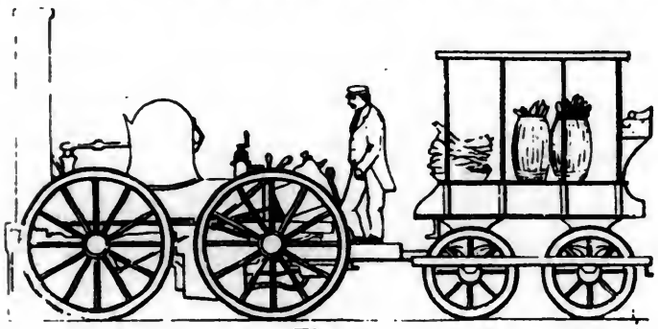

Fig. 7.

was ordered by John B. Jervis, Esq. The first excursion trip with passengers, drawn by the "De Witt Clinton," was made from Albany to Schenectady, August 9th, 1831.

On January 4th, 1831, the Baltimore and Ohio Railroad offered the sum of $4,000 "for the most approved engine which shall be delivered for trial upon the road on or before the 1st of June, 1831—and $3,500 for the engine which shall be adjudged the next best."

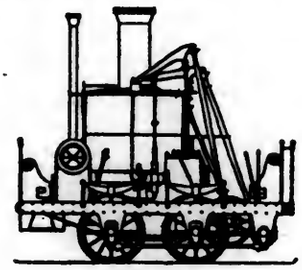

Fig. 8.

Three or four locomotives, amongst them one with a rotary engine, built by Mr. Childs, of Philadelphia, entered into the competition during the summer of 1831. The only one of them, named the "York," which proved equal to the moderate performance required of them, was the one built by Messrs. Davis & Gartner, two machinists of York, Pa. The engines had a vertical boiler and vertical

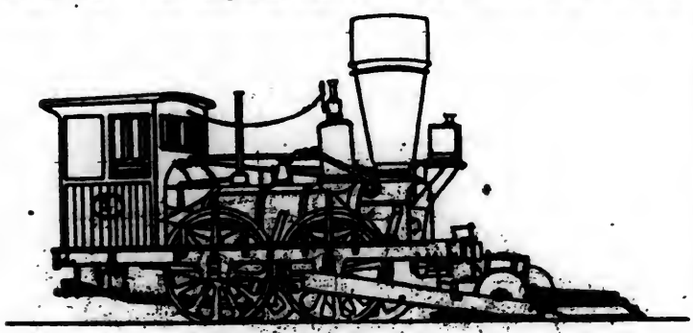

Fig. 9.

cylinders, with four coupled wheels 30 inches in diameter. It was altered considerably after being placed on the road. The "Atlantic" was afterwards built by the same firm, and was the first of what were afterwards known as the grasshopper engines (Fig. 8), which were used for many years on the Baltimore and Ohio Railroad.

In August, 1831, the locomotive "John Bull" (Fig. 9), built by George & Robert Stephenson & Co., of Newcastle-upon-Tyne, was received in Philadelphia for the Camden and Amboy Railroad and Transportation Company. This is the old engine which was exhibited at the Centennial Exhibition in Philadelphia in 1876. In the winter of 1831 or 1832, three locomotives built by the same firm in England were received and were put to work on the Newcastle and Frenchtown Railroad in Delaware.

The third edition of "Wood's Treatise on Railways," published in 1838, contains a tabular statement which gives the names and dimensions of engines built by R. Stephenson & Co., Newcastle-upon-Tyne, and the names of the railways for which they were built. This table contains the names of the following locomotives for American roads:

"Delaware," for Newcastle and Frenchtown Railroad.
"Maryland," " " " " "
"Pennsylvania," " " " " "
"No. 42," for Saratoga and Schenectady Railroad.
"H." and "Mohawk," for Mohawk and Hudson Railroad.
"Stevens," for New York.
"No. 52," for United States.
"Edgefield," for Charleston and Columbia Railroad.
"Brother Jonathan," for Mohawk and Hudson Railroad.
"No. 61." " " " " "
"No. 75," for Saratoga and Schenectady Railroad.
"Wm. Aiken," for Charleston and Columbia Railroad.
"No. 99," " " " " "
"No. 104," for Pennsylvania Railroad.
"No. 105," " " "
"No. 106," " Columbia "

No dates are given in the table, but all of these sixteen

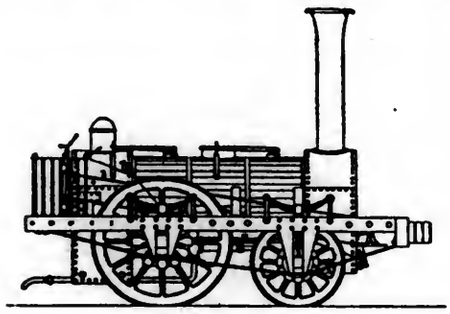

Fig. 10.

engines must have been built before 1838. Most of them were probably of what was known as the "Planet" class (shown by Fig. 10), which is the form of engine that succeeded the "Rocket," and the only one which the Stephenson's built for some years after its adoption. These locomotives, which were imported from England, doubtless, to a very considerable extent, furnished the types and patterns from which the engines which were afterwards built here were fashioned. But American designs very soon began to depart from their British prototypes, and a process of adaptation to the existing conditions of the railroads in this country followed, which afterwards "differentiated" the American locomotives more and more from those built in Great Britain. Until recently, a marked feature of difference between American and English locomotives has been the use of the truck under the

former. Its use was proposed by Mr. Horatio Allen, in a report dated May 16th, 1831, which he made to the South Carolina Canal and Railroad Company, of which he was then the chief engineer. The locomotive with two trucks (shown by Fig. 6) was built from his design in the latter part of 1831, and was put into operation on the South Carolina Railroad in the early part of 1832. In the latter part of the year 1831, the late John B. Jervis invented what he called "a new plan of frame, with a bearing carriage, for a locomotive engine, for the use of the Mohawk and Hudson Railroad (represented by Fig. 11), which was constructed and put on the road in the season of 1832."

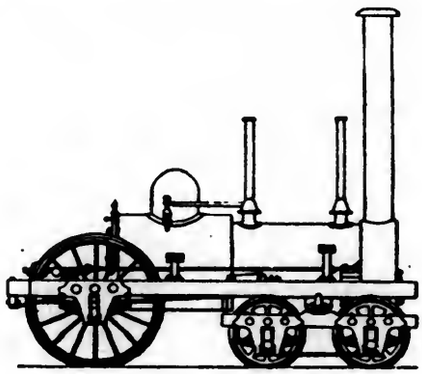

Fig. 11.

A truck was also devised by Ross Winans and applied to a locomotive on the Baltimore and Susquehanna Railroad (now the Northern Central) in the latter part of 1832 In a letter published in the AMERICAN RAILROAD JOURNAL of July 27th, 1833, Mr. Jervis describes the objects aimed at in the use of the truck, as follows:

"The leading objects I had in view, in the general arrangement of the plan of the engine, did not contemplate any improvement in the power over those heretofore constructed by Stephenson & Co.;* but to make an engine that would be better adapted to railroads of less strength than are common in England; that would travel with more ease to itself and to the rail on curved roads; that would be less affected by inequalities of the rail than is attained by the arrangement in the most approved engines."

The effectiveness of the truck in accomplishing what it was intended for was at once recognized, and its almost general adoption on American locomotives followed.

In the year 1833, Judge Dickerson, then president of the Paterson and Hudson River Railroad, ordered a locomotive, which was called the "McNeill," from George Stephenson, which was to be as good as possible, without regard to cost. It arrived and was put in operation in the year 1834. The cylinders were 9 inches diameter by 18 inches stroke, and the engine had one pair of driving-wheels five feet in diameter, which were behind the fire-box. The axle was cranked, and the cranks were close to the wheels; there was room for the connecting rods to pass by the outside of the furnace. The front end was supported by a four-wheeled truck; the fire-box and tubes were of copper. The engine continued in use many years, and was said to be very fast, and was finally sold to a western railroad, the business of the Paterson and Hudson River Railroad having grown beyond the engine's capacity.

There may have been other English engines, of which there is no record, imported into this country about this time, but, as already stated, there is no doubt that to a verp considerable extent the English engines were the models from which American designers received many suggestions; but, as will be shown, they very soon began to depart from the original types, and the development of the locomotive here was quite distinct from that which it had in Europe.

(*To be continued.*)

* The truck was applied by Mr. Jervis to an engine built by Stephenson & Co., of England.

Where Eight Hours Might be a Day's Work.

MR. EDWARD ATKINSON shows, in a late number of *Bradstreet's*, that in each 1,000 workers in the United States, only 100 are engaged in occupations upon whom an eight-hour law could be enforced, and that consequently the passage of such a law would simply operate to depress the trades upon which it could be enforced, relatively to all other trades. In the first place, agricultural labor, cattle and sheep growing, horticulture and fishing could not be subjected to an eight-hour law, and, if they could, it would ruin them. Blast furnaces, gas works, bakeries, restaurants and all other employments requiring continuous heat could not be subjected to the eight-hour rule without instant destruction. Paper mills require continuous operation. So also do railroads. There then are the great multitude of employments that the officers of the law can never reach, or know anything about, the people who work at home, such as seamstresses, washerwomen, carpenters, blacksmiths—in short, everybody who is his own employer. The only trades that could be reached are those where large numbers of workers are collected together for the purpose of attending machinery, such as cotton and woolen mills, rolling-mills, boot and shoe factories, and the like. These number not more than one in ten of the people of the United States who work with their hands. As to these Mr. Atkinson says, with his usual penetration: "If the advocates of an eight-hour law should get it passed, the first efforts of the same men who had promoted it would be to find out how to work overtime to the best advantage in order to gain a better subsistence. The logical results of all such acts by which the free conduct of adults is restricted in certain specific cases is to limit the full use and benefit of labor-saving machinery, and thus to lengthen the necessary hours of work of the great mass of the people.

The Production of Iron in Great Britain.

THE total make of pig iron in Great Britain, in 1885, was 7,250,657 tons, against 7,528,966 tons in 1884, a decrease of 278,309 tons, or about 3½ per cent. The decrease compared with 1883 is 14½ per cent. The decrease last year was general with the exception of Nottinghamshire and Leicestershire, they increasing by 88,987 tons. The total stock of iron in 1885 was 2,362,169 tons, an increase of 542,702 tons; these figures are, however, only estimates. The total production of Bessemer steel ingots in 1885 was 1,247,901 tons, a decrease of 52,675 tons, or about 4 per cent., as compared with 1884. The only district showing an increase was South Wales, from 387,728 tons to 403,114 tons. Only 671,583 tons of steel rails were made in 1885, against 784,968 tons in 1884; in 1882 the production reached 1,235,785 tons.

New Inventions.

Mowry's Car-Coupling.

JACOB C. MOWRY, of Rising Sun, Ohio, is the inventor of a new and improved form of car-coupling, which is herewith illustrated and described. This invention relates to an improved car-coupling; and it consists of the novel construction and arrangement and peculiar combination of parts, substantially as hereinafter fully set forth, and explained.

In the accompanying cuts, Fig. 1 is a perspective view of a car-coupling embodying the invention. Fig. 2 is a vertical central sectional view through the device. Fig. 3 is a bottom plan view.

A designates the draw-head, which is secured to the car-body in the ordinary well-known manner, and provided with the link-chamber A', which is of the ordinary class. The draw-head is provided with a longitudinal slot B, that opens into the chamber A', and terminates a short distance from the front thereof, to provide a solid front or cap C, to the draw-head; and the draw-head is further provided near its rear end with integral abutting flanges *c*, that bear against the car-body, and in the lower wall of its chamber with a short longitudinal slot *c'*.

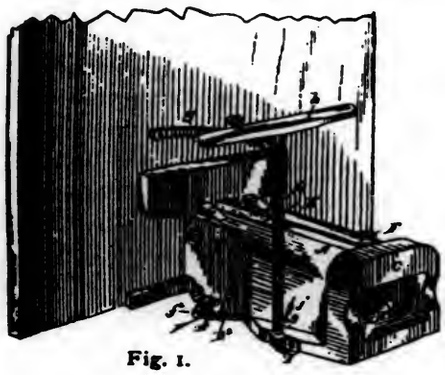

Fig. 1.

MOWRY'S CAR-COUPLING.

D designates a coupling bar or hook, which is arranged in the slot B, and is free to move longitudinally therein for a limited distance. The upper edges of the draw-bar lie flush with or a little below the upper edges of the slot in the draw-head, and at its front edge it is provided with a depending hook *d*, which is preferably curved or inclined, so as to permit a coupling-link of an approaching draw-head to enter. The rear end of the draw-bar or hook has a transversely-arranged longitudinal slot *d'*, through which passes a pivot or bolt d^2, that is also passed through and detachably secured in the draw-head, and the draw-bar is elevated by an oscillating arm or lug D', that is journaled on a pin D^2, and depends from and projects through the slot *c'*, of the draw-head, so as to be acted on by the devices for elevating the hook-shaped end of the draw-bar to release the coupling-link. The free hook-shaped end of the draw-bar is normally depressed and arranged in the path of an approaching coupling-link by means of a spring E, one end of which bears against the coupling-bar, and the other end is secured to a transverse pin or bolt *e*, that passes through the draw-head, to detachably secure or connect the spring thereto.

The coupling-hook or draw-bar D, can be elevated from the side of the car without requiring the brakeman to pass between the cars, by means of a horizontal rock-shaft F, that is journaled in suitable bearings *f f'*, and carries an arm or leg f^3, at its inner end, that is adapted to impinge against the arm D, that elevates the draw-bar when the rock-shaft is turned by manipulating the handle or crank f^3, at the outer end thereof, the journal or bearing *f'*, being secured to the draw-head to support the inner end of the shaft, and the bearing *f*, secured to and depending from the car-body at the outer side thereof to support the outer end of the shaft.

G designates a vertical rod which extends to the top or roof of the car-body to operate or elevate the free hook-shaped end of the draw-bar from the roof, and this rod is journaled in suitable bearings *g g'*, secured to the draw-head and car-body. The upper end of the rod is provided with a handle or band-wheel *h*, to be grasped and turned by hand, and the lower end of the rod is provided with a right-angled crank I, that has pivoted to its free end a link *i*, which in turn is pivoted to the free end of the arm D', to elevate the draw-bar.

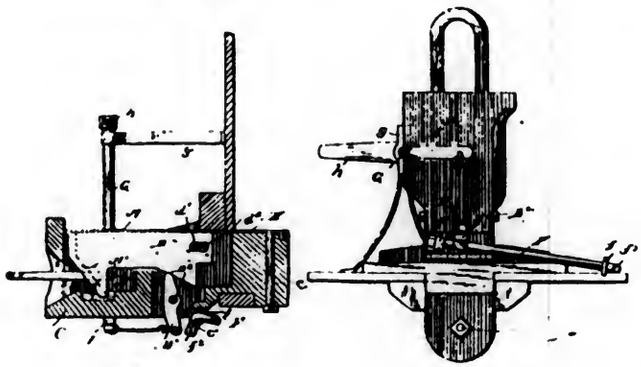

Fig. 2. Fig. 3.

MOWRY'S CAR-COUPLING.

This being the construction of the device the operation thereof is as follows: When the coupling-link of an approaching car enters the draw-head and strikes the inclined or curved edge of the draw-bar hook *d*, the latter is elevated against the tension of the pressure-spring and is forced rearwardly for a limited distance, thus permitting the link to pass beneath the hook and engage the hook *d*, thus automatically coupling the cars. The impact of the coupling-link on the draw-bar forces it rearwardly, as above mentioned, to reduce the shock on the parts of the draw-head, and when the cars are started or in motion the link draws the coupling-bar forward, and the front end thereof engages with the cap C, thus providing an increased bearing-surface therefor. To uncouple the cars, the rock-shaft or vertical rod G, is operated by hand from the side or roof of the car-body to elevate the upper end of the oscillating arm D', and consequently the hook-shaped end of the coupling-bar, whereby the hook *d*, is drawn from engagement with the link, and the latter can then be easily withdrawn from the draw-head. It will thus be seen that an improved coupling is provided which will automatically couple the cars and can be operated to uncouple the cars from either the side or roof of the same, thus providing means which do not require the brakeman to endanger his life in passing between the cars to couple or uncouple them.

The rod G, has a projecting pin *j*, that bears against the draw head to limit the rotation thereof.

In lieu of supporting one end of the spring on a pin or bolt and having its opposite end bear on the draw-bar, the spring can be rigidly secured to and carried by the coupling-bar and bear on the draw-head or other device at its opposite end to normally depress the hook-shaped end of the draw-bar in the path of an approaching link.

It is claimed for this form of car-coupling that it is perfectly adapted to its purpose, and will couple on grades or curves, while its application is economical, and the construction simple and thoroughly durable.

The device is under the control of the inventor, to whom all inquiries and communications should be addressed.

Brewer's Horseshoe.

WILLIAM N. BREWER, of Cleveland, O., is the inventor of a new and improved form of horseshoe which is herewith illustrated and described. This invention relates to improvements in horseshoes in which removable calks having T-shaped heads are secured, respectively, between depending lugs, the latter having undercut inner faces to correspond with the calk-heads. The calk is held to its seat by a key interposed between the head of the calk and the body of the shoe, and each pair of lugs

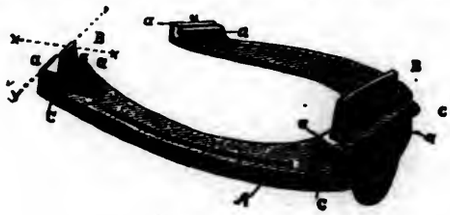

Fig. 1.

BREWER'S HORSE-SHOE.

have a connecting cross-bar at one end and internal shoulders at the other end, that engage the end of the calk-head when the latter is seated, to the end that the calk is held by the said cross-bar and shoulder from being displaced endwise, and the key, serving only as a blocking to hold the calk to its seat, does not cause extra strain on the parts.

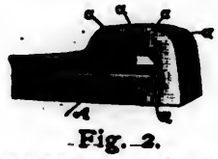

Fig. 2.

BREWER'S HORSE-SHOE.

In the accompanying cuts, Fig. 1 is a view in perspective of a horse-shoe embodying the invention, one of the heel-calks being removed. Fig. 2 is an enlarged view in perspective, showing one of the sockets of the heel-calks, looking from the outside of the shoe. Figs. 3 and 4 are enlarged elevations in section, respectively, on the lines *x x* and *y y*, Fig. 1.

A represents the body of the horseshoe, and B the detachable calk. The calks have T-shaped heads that are secured between lugs *a*, the latter being made integral with the body of the shoe and set in pairs, the lugs having undercut inner sides to correspond with and form seats for the head of the calk when the latter is separated slightly from the body of the shoe. The lugs for the heel-calks are set obliquely, the inner ends thereof extending farther rearward, as shown. Each pair of lugs *a*, is connected at one end by a cross-bar *a'*, the latter being separated from the body of the shoe to leave room for the passage of the point of the key C. The cross-bars are preferably respectively on the inner end of the lugs at the heel of the shoe. The toe-calk being set straight across the shoe, the cross-bar may be on either end of these lugs. The cross-bar forms an abutment for one end of the calk, the latter being entered from the opposite end of the lugs. At the open end the lugs have internal

Fig. 3.

BREWER'S HORSE-SHOE.

shoulders a^2, that abut the ends of the calk-head when the latter are seated. In entering the calks the heads thereof are placed against the body of the shoe and the calk slid endwise between the lugs, the flanges of the heads passing under the projections that form the shoulders a^2. The calk having been cut of suitable length, when the latter abuts the cross-bar, the other end thereof will fit nicely inside the shoulder a^2, when the calk is brought to its seat. The key C, is inserted between the body of the shoe and the head of the calk, and holds the latter to its seat, and the cross-bar and shoulders of the lugs hold the calk from moving endwise. The key C, only serves as a blocking; and it is not necessary to drive the key with any considerable force, but, on the contrary, the key need only be crowded in tight enough to prevent it from rattling, and therefore does not strain the lugs or

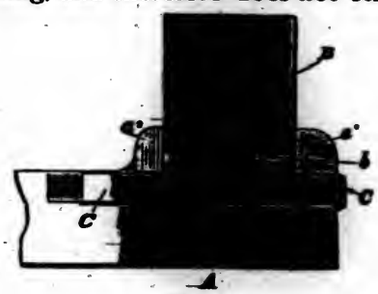

Fig. 4.

BREWER'S HORSE-SHOE.

the body of the shoe between the lugs. The removable calks of a horseshoe receive heavy and oft-repeated knocks against the paving-stones, and if the lugs are under heavy strain from keying the calks, they are likely to be broken or bent so as to loosen the calks. With this improved construction the lugs, as aforesaid, are not under any strain from keying, and therefore not liable to be broken. By the reason of the oblique line in which the heel-calks are set the tendency is to drive these calks inward and rearward; but the inner ends of the heel-calks, as aforesaid, abut the cross-bar *a'*, and are there[illegible]

securely from displacement in this direction. The aforesaid shoulders are ample to hold the calks firmly in the other direction. The toe-calk, being set straight across the shoe, is less liable to be driven endwise, but it is held in the same manner by the shoulders on one end and the cross-bar on the other. The shoe is preferably made of malleable cast-iron, or of steel casting, if preferred, and the calks are made of steel, the latter being rolled into bars of suitable size and shape in cross-section, from which bars the calks are cut into suitable lengths. The keys are rectangular in cross-section, and made slightly tapering lengthwise, and the key-seat on the body of the shoe is made to correspond with the tapered key. After the key is in place the point thereof is bent, riveted, or upset a trifle to prevent the key from backing out. Such fastening, however, does not prevent the key from being readily removed by means of a hammer and punch.

It is claimed for this device that it is simple, economical and durable, and efficiently answers the purpose of its invention, while in wear on both horse and shoe it is a great improvement on the ordinary form.

Kells's Car-Starter.

HERBERT KELLS, of Astoria, N. Y., is the inventor of a new and improved form of car-starter, the construction and operation of which is herewith illustrated and explained. The object of this invention is to utilize the weight of the car by means of a movable frame or platform placed under the car, in connection with pawls working in ratchet-teeth placed on the wheels of the car, so that by removing temporarily the weight of the car

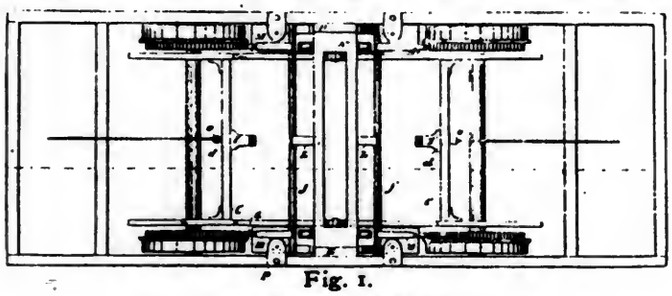

Fig. 1.

KELLS'S CAR-STARTER.

from the axle and then allowing it to press upon the movable platform the pawls are forced into the ratchet-teeth, imparting a starting motion to the whole car.

The invention consists in making a movable frame or platform provided with springs, and so arranged by means of guides as to be capable of moving perpendicularly, and is supported when at rest upon the axle of the wheels of the car. The platform or frame is so formed by means of inclined sides as to raise the springs attached thereto in a perpendicular direction. These springs have their lower bearing upon the platform or frame and their upper bearing upon the bottom of the car, and when the frame is moved in either direction the weight of the car is necessarily taken from the pedestal-springs and supported by the springs of the platform. Attached to the inner side of the car-wheels are placed ratchet-wheels of almost the same circumference as the wheels. Attached to each side of the frame or platform are weighted pawls adapted to act on the ratchet-wheels. Attached to the frame of the car is also provided a rock-shaft provided with stop arrangements, which is acted upon by a projection upon the sliding platform, so as to force the pawls into the ratchet of the car-wheels when the sliding platform is brought into operation. The sliding platform is brought in either direction by means of rods or chains attached to the ordinary brake-shaft of the car. When the brake-shaft is loosened again, the weight of the car pressing upon the springs of the platform forces the platform down and presses the pawls against the ratchet on the car-wheels, causing them to mesh into and work said ratchet and thus start the wheels in motion.

In the accompanying cut, Fig. 1 represents a plan view of the improved car-starter. Fig. 2 is a sectional view of the same through the dotted lines *x x*.

Upon the inner side of each car-wheel is securely fastened a ratchet-wheel A, of nearly the same circumference as the car-wheels. Resting upon the axles of the car-wheels is placed a sliding platform consisting of two slides B, having their inner portion made at a double incline, as shown in Fig. 2. These slides are connected together by cross-pieces C. Upon the middle of the frame so formed is placed a cradle D, made of an open rectangular frame having its side ends prolonged on each side, and in the

Fig. 2.

KELLS'S CAR-STARTER.

side ends of which are cut recesses E. Upon the cradle D, are placed spiral or other springs, F. Attached to the outer corners of the cradle D, are four weighted pawls G, adapted to fit into the ratchet-wheels A. Upon the sides of the car at the center are securely fastened the guides H, which fit into the recesses E, of the cradle D, causing the cradle to move perpendicularly up and down when in motion. On the cross-pieces C, at the points *d d'*, is a stop or lever I I'. Attached to the side timbers of the car are rock-shafts J J', provided with the levers L and M, and so placed in reference to the cradle that when said cradle is elevated to its highest point the lever or stop I, will engage with the lever L, and the lever M, will press upon the pawl G. Placed upon the cradle D, are the friction-pulleys N N'. Attached to the middle of the cross-pieces C, are hooks or staples O, to which may be secured rods or chains, and the other end of said rod or chain being suitably connected with a windlass or brake of the car, serves to communicate motion to the entire apparatus. The springs F, at their upper ends are suitably secured to the bottom of the car.

P represents the pedestal-frame upon which the weight of the car ordinarily rests.

The operation of the invention is as follows: The car being in motion, its weight, as before stated, rests upon the pedestal-springs, bringing the sliding frame forward by means of the chain attached to the staple or pulley O, causing the frame to slide forward. This motion of the sliding frame causes the cradle, with its attachments, to rise perpendicularly, the friction-pulleys N N', moving along the inclined sides of the frame nearest the back of the car, and the weight of the car is received upon the springs E, relieving the pedestal-springs of a portion of

the weight of the car. The lever I, of the frame engaging with the lever L, of the rock-shaft on the forward side of the car, presses the lever M, upon the pawls G, nearest to the back of the car, holding said pawls closely against the teeth of the ratchet-wheels A, on the hind wheels. The driver, when wishing to start the car again, then releases the brake and the weight of the car forces the cradle downward, carrying with it the sliding frame to its normal position, at the same time pressing the pawls G, against the teeth of the ratchet-wheel A, and thus imparting a starting momentum. When the brake is released and the platform slides backward, the pressure of the stop I, and the lever L, is removed, and the pressure of the lever M, on the pawl G, is also removed, allowing the weighted end of the pawl to act and leaving the ratchet-wheels free from all action of said wheel.

It is claimed for this device that it is simple, effective and economical, fully answering the required purpose. It has the further advantage of passing over large track obstructions, except where lying very close to the wheels.

Woodmansee's Car-seat.

CHARLES H. WOODMANSEE, of Norton, Kansas, is the inventor of a new and improved form of car-seat, which is herewith illustrated and described. The object of this invention is to provide a car-seat which may be readily reversed without interfering with other seats in the car, and relates to that particular form in which the back and seat are permanently connected and arranged to roll upon anti-friction rollers, so that these parts may be made to

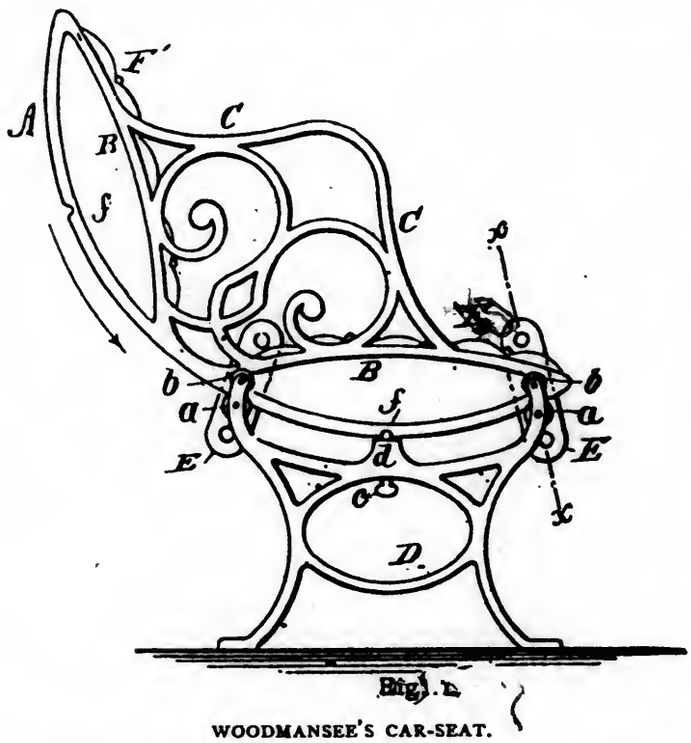

Fig. 1.

WOODMANSEE'S CAR-SEAT.

exchange functions when reversed, so that which is the back in one position becomes the seat in the other position, and *vice versa*.

In the accompanying cuts, Fig. 1 is a side elevation of the improved car-seat; Fig. 2 an enlarged detail sectional view taken on line *x x* in Fig. 1; and Fig. 3 is a detail view of the spring-acted stop for holding the car-seat in either of the positions in which it may be placed.

The end frames of the improved car-seat are formed of curved rails A, formed integrally with the curved bars B, and arm-rests C, in a single casting. The rail A, is formed on a circular curve, and is grooved longitudinally on opposite sides, and received between grooved rollers *a b*, supported by the end pieces D, of the seat-frame, or by one end piece D, and by the grooved rollers *a b*, secured to plates E, supported by the wall of the car. The curvature of the bars B, is similar to that of the rails A, but in the opposite direction, said curved bar B, forming, with

Fig. 2.

WOODMANSEE'S CAR-SEAT.

the end portions of the rails A, ellipsoidal loops of about the same shape as the cross-sections of the cushions F F', which are supported by the loops. The cushions act interchangeably as seat and back of the car-seat, and the arm-rests C, connect the bars B, and are strengthened and supported by scroll-work formed between the bars B, and the arms. The ends of the frames are symmetrical in form, so that they present the same appearance in both positions. A spring-acted bolt *c*, passes through a socket *d*, in the upper cross-bar of the frame D, and projects into one or the other of the notches *f*, formed in the rail A,

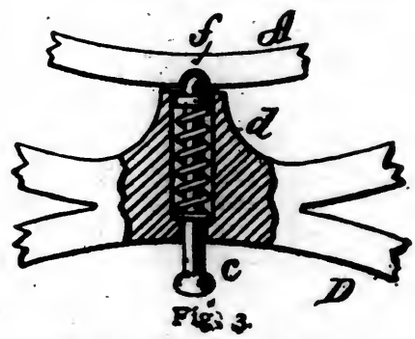

Fig. 3.

WOODMANSEE'S CAR-SEAT.

securely holding the seat in either of the positions in which it may be placed.

When it is desired to reverse the seat, the bolt *c*, is withdrawn from the notch *f*, in the rail A, when the back of the seat may be pushed down in a circular path, as indicated by the arrow, bringing the cushion F', into the position before occupied by the cushion F, so that it serves as the back of the seat.

In the construction shown and described it will be seen

that two cushions F, and F', which form, respectively, the back or seat, are sustained at their ends by the loop-shaped frames composed of bars A, and B, at some distance from each other, which leaves a small open space between said cushions that prevents the lodgment and accumulation of dirt or trash This middle portion of the frame A, which would otherwise be weak, is strongly braced by the arm-pieces C C.

It is claimed for this form of car-seat that while simple, it is throughly applicable to the purpose, and much more graceful and handsome than the ordinary form in use, and, though economical in construction, is durable and readily handled by train-men.

Both Driving Rods of an Engine Broken.

As a freight train was flying around a sharp curve near Martinsville, Ill., on June 25, at a high rate of speed, one of the driving rods of the engine, a huge ten-wheeler, broke, and instantly was revolving at a terrific rate, knocking the cab to splinters, and battering the boiler out of shape. As the train flew by the station the other rod broke and the tender jumped the track. The two rods were revolving at "lightning speed," dealing terrific blows on the cab and boiler, and the steam was escaping in clouds from the holes knocked in the boiler, while the tender was bounding along on the ties. As soon as the up grade was reached, on the other side of the station, the speed began to slacken and the train stopped, with the engine in the centre of the long bridge over the north fork of the Embarrass River. The tender jumped back upon the rails just before the bridge was reached, or a terrible wreck would probably have resulted. The engineer and firemen escaped from the cab when the first rod broke, and were not injured.

Selling Coal by Assay.

MR. C. H. ASHBURNER has proposed to the American Institute of Mining Engineers that coals should be sold by assay, just as minerals are now disposed of. He showed from average samples of anthracite coal that the percentage of ash is always much higher than is generally supposed. He thinks that there would be no difficulty in establishing a scale of fuel ratios, which would represent the actual economic value of coals.

Building for the Use of the New York Central Railroad Employes.

AT a recent meeting of the directors of the New York Central and Hudson River Railroad Company, a letter from Cornelius Vanderbilt to President Depew was read, in which Mr. Vanderbilt said:

"I have had plans prepared for a building 80 feet front by 40 feet in depth, to be used for the benefit of railroad men in the service of the companies centering at the Grand Central Depot. It will be a substantial structure, with bath-rooms, gymnasium and bowling alleys in the basement; reading rooms, library, room for games, and offices on the first floor; a large hall for general meetings and rooms for classes on the second floor; and rooms for janitor's family, and sleeping-rooms for men coming in late, or detained in the city over night, in the upper story. I wish you to lay before the Board of Directors this proposition: If the company will set apart the land at the corner of Madison avenue and Forty-fifth street (40 feet on the street by 80 feet on the avenue) for the use and purposes for which such a building would be erected, I will bear all the expense of construction and of fitting and furnishing it ready for use."

The directors authorized President Depew to accept Mr. Vanderbilt's offer and thank him. The plot of land in question was used for storing cars before the Grand Central Depot was extended.

Shall Natural Gas be Taxed?

A CORRESPONDENT of the New York *Evening Post*, in a letter to that paper, says: "In this time of discussing taxation and protecting industries, there is one commodity that seems to be a natural subject of special taxation—natural gas. The scope and promise of this new factor in industry is such as portends no little disturbance to our iron and other industries, and there seems no good reason why the nation should not share in the benefit of this great boon, although its discovery and source be in a special district of the country.

"Natural gas, as its name indicates, is not a product of skill, is not even a surface product such as is conveyed in government titles to land. It comes from "the bowels of the earth," and one who regards its present vast influence and conjectures its future, must concede that it will throw our industries out of balance. If ever there was a suitable and equitable subject for special taxation, is not here one? The menace to the dairy sinks into insignificance in comparison with the danger to our manufacturing industries from this new and miraculous fuel. It is not too much to claim, on the score of cost alone, to say nothing of other advantages, that the cheapening of many manufactures in Pittsburgh amounts to ten per cent. How is fair competition to be maintained without a tax?"

New Towers for the Niagara Bridge.

WORK on the new towers of the Niagara suspension bridge has been commenced. Engineer Buck, who has charge of the matter, and who replaced the wooden part of the bridge with iron without delaying a single train, will now replace the stone towers over which the cables are stretched and which really sustain the whole weight of the bridge, with steel towers. It is stated that when the steel structures are ready to be put into position it will take about sixty days to finish the work. The first operation, which is now in progress, consists in removing the offices and stairways at the ends of the bridge.

A Complete Form of Monopoly.

THE creed of the Knights of Labor, as far as it has been authoritatively announced and practically illustrated, seems to embrace three distinct propositions, to wit: (1) That none but members of the order shall be given employment; (2) that a member of the order shall not be discharged from work without the order's consent; and (3) that all persons so employed shall be at liberty to quit whenever they choose, and shall quit whether they want to or not when directed to do so by the officers of the

order. It would be interesting to have some able and perspicuous oratorical Knight explain wherein such a creed as this differs from the most complete form of monopoly. The explanation should also include some information as to how labor is going to be made free and happy by being compelled to forego all right of personal judgment in order to secure a chance to earn a living.—*St. Louis Globe-Democrat.*

A Big Verdict.

THE Pennsylvania Supreme Court has a case before it where a first-class ticket was bought in 1883 from Erie to Cleveland and return. On the passenger's return he got on a limited express-train, which a railway employé told him was the next train for Erie. The conductor would neither accept his ticket nor the money tendered for his fare, and put him off late at night between stations. In walking the half mile to Cleveland he was knocked down and seriously injured in some way unknown. The jury gave a verdict for $48,750, which the court refused to reduce, and the case went up to the Supreme Court on a writ of error.

A Dwelling Wrecked at Midnight by a Runaway Freight-Car.

A CAR of an inward bound freight train from Lowell, attached to engine No. 59, on the Boston & Lowell Railroad, became detached between Short and East streets, East Cambridge, about one o'clock in the morning of July 16th. It ran a short way, then leaped the track and dashed into a two-story wooden house and completely demolished it. In its course it shattered the walls of the chamber in which Jeremiah Callahan and his wife were sleeping. Callahan received a severe blow in the side by a falling beam, his wife escaping unhurt. The children, who were sleeping in an apartment on an upper floor, escaped with a thorough shaking up. The wall of the south end has been twisted from the main structure, and now stands out in the shape of a crescent, being held at the top and bottom by the framework of the dwelling.

On the track side the whole interior of the house was laid open.

Railways in Congress.

TO properly estimate the present railway activity, it is well to consider the number of bills before Congress affecting that interest. In the list of bills just passed by the House no less than 24 bridges are included, of which eight are to cross the Missouri river and four the Mississippi river. The crossings of the Missouri river are to be made at St. Joseph, Council Bluffs, Saline City, in Clay or Jackson counties, and above St. Charles, all in Missouri, and near Atchison, Kan., near Chamberlain and at Pierre, Dak. The points at which the Mississippi is to be crossed are near Alton, Ill., near Keithsburg, Ill., at Winona, Minn., and at Red Wing, Minn. Other rivers which are to be spanned are the Detroit, the Tennessee, the Illinois, the St. Croix, the Kansas, the Yellowstone, the Tombigbee, the Warrior, etc.

A THOROUGH test of iron ties by the Pennsylvania Railroad Company has resulted in the company refusing to adopt them.

GENERAL OFFICES **THE ROTE AUTOMATIC BRAKE COMPANY,**

MANSFIELD, OHIO, *November 3d, 1884.*

To the Westinghouse Air Brake Company, Pittsburgh, Pa.:

GENTLEMEN:—Understanding from your published announcements that you recommend your brake for freight-train use we respectfully invite you to a complete and searching public test of its merits in competition with the *Rote Automatic Brake* This test to be made in so complete and critical a manner as to show all the railroads of the country, as well as the Railroad Commissioners of the various States, which of the two brakes is the one which should be used; for the test will, we are certain, leave no doubt in the minds of any witnessing it.

To insure the proper management of the test we suggest that you choose one person, we another, and these two a third person, all three to be well known as capable and honorable rolling-stock experts, to conduct the test, their expenses to be jointly borne by you and by us.

An invitation to witness the test to be extended to the General Officers of Railroads and all State Railroad Commissioners to the members of the National Car-Builders Association, and to the Railroad and daily press.

The test to be at such time and place as may be mutually agreed upon, but we suggest that the proper place would be on some road having high grades and sharp curves, so that both brakes may have as hard and complete a test as possible. As it is necessary to make the test searching and complete, and as all railroads wish to increase the length of their trains and only wait for a brake which will enable them to do so, we think each train should be made up of 50, 60 or 70 cars, as you may prefer, or, if you think best, of even more cars.

Your company to supply your train and engines, we to supply ours.

The following points, among others, to be considered and reported upon:

Cost of equipping trains.

Simplicity.

Freedom from breakage.

Certainty of action.

Effectiveness.

Cost of maintaining.

"Flatting" of wheels.

Any other points submitted by you or by us in writing to be added to the above.

The brakes or trains are to be tested in every manner and under all conditions which practical railway service may suggest, including yard as well as line service.

Among others the following tests are to be applied to both trains:

1st.—Each train is to be (part of the time) run by engineers and crews who have never operated either brake and who are wholly unfamiliar with them.

2d.—The trains are (part of the time) to be partly made up (as nearly all freights are everywhere) of foreign cars, which have neither your nor our brake on, so that the cars having your break or ours on shall be widely and irregularly separated from each other.

3d.—The locomotives drawing your train and ours to be exchanged, from time to time, and draw each others trains.

4th.—Two locomotives equipped as so many freight engines and tenders are, with hand-brakes instead of steam or air brakes, are to be substituted for the two engines used in the test part of the time. Any brake which will not work properly if this is done, you will admit, can be of little practical value in actual service.

5th.—From time to time each train is to be stopped and foreign cars (not equipped with either your brake or ours) are to be run into it, at irregular intervals, just as actual service requires constantly.

6th.—In the making up of trains, etc., crews are to be exchanged at random, so that the test may fully illustrate the convenience of operating each kind of brake in actual ordinary service.

7th.—Frequent short runs, stops and quick starts are to be made.

8th.—A series of yard tests are to be made, showing the action, convenience, etc., of the two brakes.

We mention a few necessary tests only, and you and we, as well as the test committee, are to add any number of others, it being distinctly understood that if you decline any test proposed by us, or we decline any proposed by you, it shall be condered an explicit and positive admission of inferiority.

This rule must in every case be strictly observed, namely: *Both brakes must be tested in precisely the same manner*, so that there may not only be absolute fairness, but no room for suspicion even of anything else.

You have been in the brake field a long time, have profited justly and largely from the patronage of railroads, and we are sure will welcome this plan for allowing your patrons and the American public to judge for themselves which brake should come into universal use.

Having proper confidence in the merits of your brake we know you will gladly and promptly accept our proposition herein made, as you must feel that the test will be complete.

The railroad public is a very fair-minded, capable body, and will most thoroughly appreciate and fully recognize the equity and fairness of our offer to you, and, in common with business-like people everywhere, will naturally (and, we are sure you will admit, properly) consider it a virtual confession of inferiority and a public admission that the Westinghouse Brake is inferior to the Rote Brake and that it is unfitted for general freight service, should you decline or neglect to avail yourselves of the proposition we make you herein.

Permit us to add in closing that we wish to express to you our desire to have this communication received in the spirit in which it is sent, and to have it express to you our wish for a full, fair and searching test of the two articles in the relative merits of which the railroad interest is *primary* and that of the owners even secondary. Respectfully,

THE ROTE AUTOMATIC BRAKE COMPANY,

Per M. D. HARTER, President.

American Railroad Journal.

WHOLE NO. 2,579.] NEW YORK, AUGUST, 1886. [VOLUME LX.—No. 5.

TRADES UNIONS AND STRIKES.*

(Concluded from Page 113.)

IT is well known that employers in various trades frequently act in combination. For instance, the iron-masters in the midland counties hold quarterly meetings at which a scale of wages and prices is fixed. Every iron-master considers himself bound to conduct his trade in strict accordance with the scale agreed upon. If any one should disobey the decision of the meeting, he would subject himself, not indeed to personal violence, but to a social terrorism very analogous to that by which trades unionists so frequently maintain their organizations. The recalcitrant iron-master would be abused by his fellow employers, and very probably an effort would be made to ruin one whose conduct was supposed to be injurious to the interests of his class. It is impossible fully to understand the effects resulting from combinations of workmen unless it is remembered that similar combinations are formed by their employers.

Let it be supposed that the iron-masters at one of their meetings decide, in consequence of a prosperous state of trade, to advance wages 10 per cent. The iron-masters, who, like other people, are liable to mistakes, may not have made such an advance in wages as the state of the trade would fairly admit. Wages might, perhaps, have been raised 20 per cent., without unduly trenching upon profits. A laborer, impressed with the conviction that an advance of 10 per cent. is not sufficient, demands something more from his employer. The employer, who has entered into a compact with others of his class as to the wages which shall be paid, must at once feel the advantageous position he occupies in resisting the demands that the laborers make upon him, if they have no organization for combined action. He knows that if any of them refuse to work for him, they will be unable to obtain higher wages from other employers in the locality, because, by previous agreement, a uniform rate of wages prevails. A laborer has seldom saved sufficient to be able to maintain himself for any length of time without work; he makes a great sacrifice if he seeks another occupation to which he is unaccustomed, and especially at a time when his own trade happens to be exceptionally prosperous. It therefore appears, that the bargaining which often goes on in adjusting wages, implies a struggle, or a conflict of effort, between employers and employed; in this conflict a great advantage will be possessed by those who can act in concert, over those who simply act as isolated individuals. The truth of this will be more distinctly perceived by considering what would occur if, in the case just described, the laborers combined to make a demand for a greater advance in wages. Assume that in the iron trade there is a powerful trades union; that all the laborers in the district belong to it, and that they are as well organized as their employers. The representatives of this trades union would feel that they were placed in a position of equality with their employers, when making a demand for higher wages; the employer also would know that, as a last resource, a strike would be agreed upon. This would bring business to a standstill, and thus trade would be suspended when it was very prosperous, and when exceptionally high profits were being realized. The loss and inconvenience thus inflicted upon employers would be a strong inducement to them to yield to the demand of their laborers, if it could be fairly conceded. Each party to the bargain would thus be placed in a position of equality when arranging its terms.

In the example just investigated it has been implied that the employers do not, in the first instance, offer an adequate advance in wages. It often, however, happens that the laborers err on their side, and insist upon wages which cannot be fairly conceded. The only security against such errors is the serious loss inflicted both on masters and men by trade disputes. It is difficult adequately to estimate the loss which is caused to each party by such a suspension of business. The employers not only have a vast amount of capital lying idle, but a very considerable portion of their trade may permanently pass away to other localities. When business is recommenced many of their former laborers have left the district, and their places have to be occupied by inferior workmen. During a strike, laborers often endure the most severe hardships; the savings of many years are spent, and so acute is the distress, that even household furniture has sometimes to be sold. All this suffering is aggravated by the losses inflicted on the employers, because if a great amount of capital is sacrificed in the conflict, less will remain to be distributed in wages when work is resumed.

There can be no doubt that in the majority of strikes the masters have been sufficiently powerful not to concede the demands of their workmen. Not only do the superior resources of the employer enable him to carry on the struggle for a longer period, but workmen are generally such unskilled tacticians that they usually strike, not to secure an advance in wages when trade is prosperous, but to prevent a reduction when trade is depressed. In times of depression a temporary suspension of business may very possibly be rather an advantage than a loss to employers. Consequently, at such a time the prospect of a strike implies by no means so formidable a threat as when trade is active.

From the tenor of these remarks it appears that strikes are inseparably associated with our present economic system. As long as the relations between employers and employed continue to be analogous to those existing be-

* From Fawett's "Manual of Political Economy," Macmillan & Co.

tween the buyer and seller of a commodity, it must often happen that the one party will refuse to accept the price which is offered by the other for labor: if the refusal is persisted in, a strike inevitably ensues. When strikes are regarded from this point of view it is as hopeless that legislation can prevent them, as it is to suppose that merchants could be compelled to sell their goods if an inadequate price were offered for them. Something may no doubt be done by conciliation and arbitration, either to obviate or to render less frequent the trade disputes arising between employers and employed. A master who exhibits great personal interest in his workmen's welfare, is generally able amicably to settle any difference which arises in his business upon a question of wages. Experience has also shown that the establishment of courts of arbitration often enable trade disputes to be arranged, without recourse being had to the disastrous expedient of a strike. The efficiency of these courts depends to a great extent upon making a wise selection when choosing an umpire. It is usual for the employers and employed to have an equal number of representatives in these courts of arbitration. The ultimate decision has therefore sometimes to be made by the umpire or referee, who must be a person absolutely unsuspected of any bias towards either party in the dispute.

Such expedients as personal conciliation and courts of arbitration, although exerting a most useful influence, do not provide a completely efficient remedy for strikes. These disputes must be regarded as the natural outgrowth of the existing relations between employers and employed. In order to obtain a complete remedy for strikes, it will be necessary to remove the antagonism of interest now existing between employers and employed. Some plan must be adopted which will make masters and workmen feel that they have an identity of interest. It is no doubt true that all those who are engaged in any business have a common interest in its prosperity; but the grave defect connected with our present economic arrangements is, that the amount of advantage or disadvantage which is derived from prosperous or adverse trade by employers and employed is not arranged according to any definite plan, but is too frequently settled in an angry struggle of rival pecuniary interests. Various schemes have already been tried with considerable success, which correct the defect alluded to, and which introduce a system of copartnership or profit-sharing between masters and workmen. These schemes are based upon the general principle that laborers should not work simply for hire, but should participate in the profits which are realized by their industry. It has been previously shown that the power of combination enables workmen more surely to participate in the profits realized in times of active trade. From this it would appear that the power of combination establishes, as it were, by force, a copartnership between employers and employed.

If this fact should obtain general recognition it may be anticipated that the principle of copartnership will be generally introduced into our industries. In order to show that there are no practical difficulties opposing its introduction, which cannot be ultimately surmounted, we will proceed to describe some of the cases in which it has been applied.

One of the first and most valuable experiments was made by M. Leclaire, a house decorator in Paris. The experiment, though well known, is particularly important, because its results have been verified by the most accurate testimony. In 1840 M. Leclaire employed about 300 workmen, and the carelessness and apathy of his men subjected him to constant loss and annoyance. He therefore resolved that he would endeavor to make the labor of his men more efficient by giving them some pecuniary interest in the work in which they were employed. He calculated that each workman, by putting more zeal into his work, could, without prolonging the hours of labor, produce surplus work equal in value to 6d. a day; and also that an additional 2½d. a day could be saved by each workman if he exercised greater care and economy in the use of tools and materials. In 1842, acting on this calculation, he assembled his men together and told them that he proposed to give them the whole of this extra 8½d. a day, or £10 a year, if they would earn it, and he overcame the doubt and suspicion with which his proposition was at first regarded by dividing there and then with the 44 men who, he reckoned, would be entitled to participate, the profits of the preceding year. From this moment the success of the scheme dates. The workmen were convinced of Leclaire's sincerity, and the scheme, which is based upon the extra productiveness given to labor by the principle of profit-sharing, has been a most remarkable success. A mutual aid society was started in connection with it, which gives all its members pensions and annuities when they are disabled by age or sickness. The success of the system originated by Leclaire is strikingly manifested by the fact that it was so organized as to be independent of the fostering care of its author. Leclaire died in 1872, but the "*Maison Leclaire*" has more than maintained its prosperity since that date; the business of the society, and the share of profits allotted to labor, have steadily increased.

As another example, it may be mentioned that the Paris & Orleans Railway Company distributes a certain portion of the profits raised amongst the working staff of the railway, and it is unanimously affirmed by the directors that the plan succeeds admirably. The amount now distributed is equivalent to about 10 per cent. on wages, the wages paid being the same as on other French railways. The plan has been in continuous operation since 1844, and the whole amount received by the employés of the Company between that year and 1880, as their share of profits, is no less then £2,395,000.

The fact that the late M. Leclaire and others have been abundantly recompensed for the share of profits allotted to workmen, deserves particular attention. It shows that copartnership does not require from the employer any sacrifice on behalf of his workmen, but, on the contrary, that both are equally benefited. The efficiency of labor and capital must evidently be greatly increased, by improving the relations between employers and employed; and when labor and capital become more efficient, there is more to distribute both in wages and profits. The error is not unfrequently committed of supposing that the share of profits allotted to labor represents so much abstracted from the returns of the capitalists. The Royal Commissioners, who in 1869 reported upon trades unions, failed to appreciate the advantages resulting from copartnership, because they assumed that the share of profits

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received by the laborer was so much taken from his employer. If this were so, no particular benefit could attach to the system, because there would be no identity of interest established, if what was gained by the laborer were lost by the capitalist. The fundamental advantage of these schemes arises from the circumstance that the benefit they confer is mutual; the share of profits received by the laborer is a measure of the gain secured by the employer, as a consequence of the additional efficiency given to labor and capital by introducing harmony, where before there was antagonism and rivalry of interest. Some idea may be formed of the enormous saving which might thus accrue. Not only would the loss inflicted on industry by strikes and lockouts be avoided, but a vast amount of waste would be obviated. Employers constantly complain of the loss they sustain from the listlessness and apathy of their workmen. A heavy outlay has to be incurred in overlooking laborers, in order to see that work is not shirked. In some branches of industry it is impossible to obtain anything like an adequate supervision; the labor is too much dispersed. This is particularly the case with agriculture, and to such a business copartnership could be applied with maximum advantage. It can be confidently asserted that a farmer would largely increase his own profits if he consented to allot to his laborers some portion of his profits. After paying them the current wages, and setting aside a fair amount as interest upon capital and as remuneration for his labor of superintendence, he might agree to distribute amongst his laborers a portion, say one-half, of any extra profits that might be realized. Each laborer's share of this bonus being determined by the aggregate amount of wages he had earned, the most would consequently be obtained by those who were the best laborers. Such an arrangement would powerfully stimulate the industrial energy of the laborer who is now proverbially slow in his movements and apathetic in his work, because he has no inducement, except when engaged in piece-work, to exert himself more than he is absolutely obliged. Other plans of industrial partnership have been adopted which secure a more complete union between capital and labor. During the last few years the practice has been rapidly extending not only of allotting to workmen a share in profits, but also of enabling them to invest capital in the business in which they are employed. When the great carpet manufactory of Messrs. Crossley of Halifax was converted into a joint stock company, one-fourth of the shares were preferentially offered to the workmen engaged in the business. This arrangement, by enabling the workmen to become part owners of the concern, gave them a far more direct interest in the prosperity of the business than if they had been employed as ordinary laborers. Another very interesting experiment was carried out by the Messrs Briggs, at their collieries at Methley, near Leeds. In this instance the workmen not only had an opportunity of purchasing shares in the company, but after a profit of 10 per cent. had been realized on capital, one-half of the surplus profits was distributed amongst the laborers as a bonus. Every workman was thus given an immediate interest in the success of the business. For many years this experiment was carried out with admirable success. Trade disputes, which had before been of frequent occurrence, altogether ceased, and the workmen were stimulated to increased exertions by the prospect of securing to themselves a share of the profits realized. The unprecedented rise in the price of coal, which took place in 1872, brought such sudden prosperity to coal-mining that it unhappily disturbed the harmonius relations between workmen and employers at Methley. A dispute arose upon the extent to which capital and labor should respectively participate in this extra profit, and the copartnership principle has unfortunately been abandoned. It is obvious from what has occurred at Methley that copartnership is likely to be carried out with the best chance of success in those branches of industry which are not liable to great and sudden fluctuations in prosperity. These considerations lead to the conclusion that the system could be very advantageously applied in agriculture. A very interesting experiment of the kind was tried a few years since, with marked success, by the late Lord George Manners, on a farm which he cultivated on his estate near Newmarket. The plan which he adopted was very simple, and resembled in all essentials the method which was carried out by M. Leclaire in Paris. The laborers on the farm received the ordinary wages which were current in the district; but it was agreed that if, through extra exertion, or greater skill on their part, extra profits were realized, a portion of these profits should be distributed among them as a bonus on their labor. Lord George Manners unfortunately died before this experiment had been long in operation; but he spoke confidently of its permanent success, and affirmed that it would prove alike advantageous to employer and employed.

It may be hoped that these copartnerships will so rapidly extend as to fundamentally change the economic relations now existing between employers and employed. There can be no doubt, as was remarked in the last chapter, that the movement will be powerfully promoted by national education; for all these schemes which have been described require men to repose a certain amount of trust in each other; distrust and suspicion are always prominent characteristics of a low state of intellectual development.

Ultimately it may be hoped that there will be so much moral and social advancement as to enable a perfect union between capital and labor to be established; this is secured when laborers supply all the capital which is required to sustain the industry in which they are engaged. When this is accomplished, there is coöperation in its highest form.

THE STATE PURCHASE OF RAILROADS.

A RECENT number of the *Fortnightly Review* contains an article on this subject, by Mr. Charles Waring, which contains some very bold and startling proposals. The following extracts will give an idea of the radical nature of the author's scheme:

PRINCIPLES OF WORKING.

"It is upon the satisfactory settlement of the principles upon which rates and fares are to be fixed that the practicability of State purchase depends. The first thing to determine is the object with which the railways shall be worked—whether as a source of profit to the treasury, or

in the promotion of industry, commerce and trade, and for the benefit of the people. Then arises the question: Is it possible or desirable for the State to retain the commercial character of management, with full powers to accommodate rates and fares to circumstances, making large or small profits, according to the nature of the traffic? We shall assume that the State would have the largest liberty both in object and means. The amount which can be got out of the railways, and the comparative advantage of using them as a revenue-earning machine, or as a means of developing the resources of the country, have to be ascertained by experiment. It is probable that, as in the case of the post-office, the railways would serve both purposes. Rates and fares might be reduced so as to give immense indirect relief to industry, and also return a direct profit to the exchequer. But this could not be done at once. In the stages of introduction, the Chancellor of the Exchequer might have to provide for a deficit on the railway accounts. Mr. Forbes says, that even the State cannot carry at a loss; but, with much deference, that is precisely what the State can do, and where it has the advantage over the companies in getting the greatest benefits for industry and commerce out of this mighty instrument of national wealth.

SOLUTION OF THE PROBLEM.

"I shall now proceed to explain the grounds upon which I have formed the judgment that the time has come when new impetus may be given to commerce not far short of that caused by the introduction of railways. This, in my opinion, can be done by establishing the railways on the basis of the post-office service, gradually eliminating distance as an element of charge in the carriage of goods, under the ownership and administration of the State. The question then arises: Is it possible, out of Utopia, to eliminate distance as an element of charge in conveyance by railway? Can a gross charge be made, according to a fixed standard for separate classes of goods, whether they travel 10, 100 or 1,000 miles? The proposition may seem a startling one, but it is to be remembered that the postage system was derided at first by men of business and political economists. A single railway rate for all distances is but a larger application of the same principle, and it has some attractions, as well as merits, which will gain it a hearing. That there are obstacles of some magnitude is obvious, but the advantages offered are of a kind which, when they are understood, will stimulate a vigorous attack upon the difficulties. I do not imagine that a paper plan can be produced which can be applied all round, and at once. It is a matter in which it would be necessary to hasten slowly. It would be advisable to experiment on goods traffic at first, and to begin with one class of goods, say coal and minerals. The scheme might afterwards be extended to merchandise, and eventually to passengers, though the reform of passenger fares is not so urgent as that of the goods rates. It would probably be necessary, in the introduction of the system, to have two or three rates, one for short distances, and others for long distances; so much for every distance not exceeding 100 miles, so much for every distance between 100 and 300 miles, and so much for all distances exceeding 300 miles, keeping the one rate for all distances in view as the ultimate object, and adapting it to the needs and circumstances of commerce by degrees. It may be asked, why not one rate for all classes of goods? That may come eventually, but my present contention is not for the entire abolition of classification. Even in the post-office, there is classification, as between letters, parcels and circulars, and special arrangements are made by the telegraph department with the press. But classification ought to be greatly simplified.

ADVANTAGE OF A SINGLE RATE.

"The advantages of one gross rate are seen in the practice of grouping, which stimulates competition to the utmost within the zone of the group. Its general adoption would remove all restrictions upon competition, and bring the produce of every district within the reach of every market. It would mean free trade in the full expression of the term, which is not alone the removal of import duties, but the greatest, freest and cheapest exchange of commodities, and the removal of every barrier between the producer and the consumer. The certainty and the simplicity of the plan would have a magical effect upon trade. Traders are now prevented from extending the range of their dealings because they do not know the rates, and cannot estimate the profits they might make. Their profits are really decided by the companies, and this acts in restraint of exchange. It is impossible to forecast the growth of commerce if traders knew generally the cost of carriage on each transaction, but it could not fail to be both rapid and large."

There is nothing in the article to indicate how the evils and abuses of State, and, consequently, political ownership and management, can be avoided. Imagine a Squire in control of the New York Central, or a Jachne managing the elevated roads in New York.

How Railroads are Built.

FOLLOWING are the chief points of an address by Henry Clews, Wall street speculator, on the topic indicated in our head:

"Under the laws of the State of New York—which are a fair sample of the laws of other States—a number of persons form a company under the general railroad laws, registering at Albany the proposed route of the road, the amount of capital stock and bonds to be issued, and a few other particulars required in the papers of incorporation. The incorporators then proceed to form themselves into a syndicate or company, for the purpose of contracting to build and equip the road. Here comes the first step in the system of 'crooked' financiering. In their capacity of incorporators the same men make a contract with themselves, in the capacity of constructors. Of course they do not fail to make a bargain to suit their own interests. They would be more than human if they did. Usually the bargain is, that the construction company undertakes to build the road for 80 or 100 per cent. of the face value of the first mortgage bonds, with an equal amount of stock, and sometimes, also, a certain amount of second mortgages thrown in, virtually without consideration.

"The first mortgages are supposed to represent the real cash outlay on the construction and equipment; but, as a matter of fact, the true cash cost of the work done and

materials furnished, ranges from 60 to 80 per cent. of the amount of first lien transferred to the constructors. The construction company disposes of the bonds, partly by negotiating their sale to the public through bankers, at an advance upon the valuation at which they had received them, and partly by using them in payment for rails and equipment. Beyond the profits made from building the road for the first mortgage bonds, there remains in the hands of the constructors the entire capital stock and any second mortgage bonds they may have received, as a clear bonus, to be held for future appreciation, and to keep control of the company and be ultimately sold on a market deftly manipulated for that purpose.

"This is the way in which a large majority of our railroads have been and still are constructed. It will thus be seen that the actual cost of a railroad is ordinarily less than 50 per cent. of the stock and bonds issued against the property, and that its first mortgage exceeds the amount of the legitimate actual cost of the road.

"The basis of all the discredit, the embarrassments, the bankruptcies and the robberies of our railroad system is thus laid at the inception of the enterprises. They rest upon an intrinsically rotten and dishonest foundation; and the evil is far from having reached the end of its mischief to the financial, political and social interest of the country.

The Functions of a Wheel and the Use of Steel Springs.

IN one of an interesting series of articles on the "Development of Transportation Systems in the United States," which Mr. J. L. Ringwalt is publishing in the *Railway World*, he has exhumed the following interesting testimony taken before a select committee of the House of Commons on steam carriages, in 1831, which was reprinted by the House of Representatives at Washington, in 1832. In response to the question, "Have you paid any attention to the general nature and advantages of wheels and springs for carriages, the draughts of cattle and the form of roads?" Davies Gilbert, a member of the committee, made remarks which embrace these extracts:

"Taking wheels completely in the abstract, they must be considered as answering two different purposes. First, they transfer the friction which would take place between a sliding body and the comparatively rough, uneven surface over which it slides, to the smooth, oiled peripheries of the axle and box, where the absolute quantity of the friction, as opposing resistance, is also diminished by leverage in the proportion of the wheel to that of the axis.

"Secondly, they procure mechanical advantage for overcoming obstacles in proportion to the square roots of their diameters, when the obstacles are relatively small, by increasing the time in that ratio, during which the wheel ascends; and they pass over small, transverse ruts, hollows or pits, with an absolute advantage of not sinking proportionate to their diameters, and with a mechanical one, as before, proportionate to the square roots of their diameters. Consequently, wheels, thus considered, cannot be too large. In practice, however, they are limited by weight, by expense, and by convenience. * * * *Springs were in all likelihood applied at first to carriages, with no other view than to accommodate travelers.* They have since been found to answer several important ends. They convert all percussion into mere increase of pressure; that is, the collision of two hard bodies is changed, by the interposition of one that is elastic, into a mere accession of weight. Thus the carriage is preserved from injury, and the materials of the road are not broken; and, in surmounting obstacles, instead of the whole carriage with its load being lifted over, the springs allow the wheels to raise, while the weights suspended upon them are scarcely moved from the horizontal level. So that, if the whole of the weight would be supported on the springs, and all the other parts supposed to be devoid of inertia, while the springs themselves were very long and extremely flexible, this consequence would clearly follow, however much it may wear the appearance of a paradox, that such a carriage may be drawn over a road abounding in small obstacles without agitation, and without any material addition being made to the moving power or draft. It seems, therefore, probable that, under certain modifications of form and material, springs may be applied with advantage to the very heaviest wagons. * * * The advantages consequent to the draft, from suspending heavy baggage on the springs, were first generally perceived about forty years since on the introduction of mail coaches. * * * The extensive use of wagons, suspended on springs, for conveying heavy articles, introduced within these two or three last years, *will form an epoch in the history of internal land communication not much inferior, perhaps, in importance to that when mail coaches were first adopted;* and the extension of vans, in so short a time, to places the most remote from the metropolis, induces a hope and expectation that, as roads improve, the means of preserving them will improve also, possibly in an equal degree; so that permanence and consequent cheapness, in addition to facility of conveyance, will be distinguishing features of the Macadam system."

Diagonal or "Scarf" Rail-Joints.

THE managers of the Lehigh Valley Railroad have for several years been experimenting with rails whose ends instead of being cut off square with the sides are cut at an angle of about 45 degrees. This form for rail ends has given such excellent results that the authorities on that road have determined to adopt it very generally. The chief obstacle in the way of doing this is the difficulty of cutting the rails in this form. To obviate this, Mr. Fritz, of the Bethlehem Iron Company, has designed a special machine, of which the following description is given in a late number of *Engineering*.

"One of the most ingenious pieces of mechanism in these magnificent mills is a recently constructed apparatus for sawing off the ends of a rail at any desired angle; it having been thought that a scarf-joint would better distribute the strains in the rail, since the wheel does not run off one rail until a part of it is on another, which is not the case in the ordinary butt-joint. The machine in question has the saw and its mandrel, together with the high-pressure horizontal steam engine that drives it, the two driving-belts, and all the pulleys, four in number, attached to a frame having at two points cylindrical bearings which can turn or slide, as desired, in two

supporting pillow blocks of peculiar form. If the end of the rail is to be cut square, the frame is so adjusted that the axis of the saw mandrel is horizontal, and the saw revolves in a vertical plane, and the whole mechanism is moved toward the rail to be cut, by sliding longitudinally in the pillow blocks; but if the rail is to be cut obliquely, the axis of the saw mandrel is first adjusted to the desired angle by rotating the frame about the axis of its cylindrical bearing, by means of a neat application of water pressure, and the frame and the saw are moved forward as before. In these movements the steam is conveyed to the engine and the exhaust from it, by means of telescopic steam pipes which slide in and out of each other. Mr. Fritz is also erecting in the new shops two train rolls 120 ft. long, and separated by about 6 ft. When the product of the roll has run on these supporting and carrying rolls it is seized by curved carrying arms attached to a horizontal shaft, with carrying hooks on its extremities, and lifted bodily from one frame to another; the method of running the piece to and from the rolls is also an evidence of Mr. Fritz's ingenuity. The conveying rollers have conical friction wheels at their extremities, similar in shape to a double convex lens; in front and behind there are similar wheels rotating on a shaft at right angles to the axis of the rolls, and which shaft is continuous and capable of being moved forward and backward by means of a hydraulic cylinder; if it is moved forward the conical wheels on the rolls engage the driving-wheels in front of them, and, if backward, those behind them."

The Headlight a Necessity.

A STATEMENT purporting to have originated with "a railway official" is going the rounds of the press, in which the affirmation is made that there is more danger in the use than the absence of headlights on locomotives. It is admitted that the headlight is good on yard engines, but the alleged official is made to say:

"On a road engine the headlight is of no earthly use to the engineer; it obstructs the vision so that he cannot see his switch lights, and I think that every thinking engineer will come to the conclusion that he would rather run in the night without a lamp than with it, as he can see better in the dark. Red cannot be seen distinctly under such a powerful light when the engine is running rapidly. A green light under the brilliant illumination of a headlight appears yellow, and a blue light appears pale. I know of accidents which have occurred from this cause, and the eyesight of every engineer having a night run is put under a terrible strain by continually gazing ahead into such a light surrounded by such dense darkness. The new electric headlight put on the market a few years ago was a success as a light giver, but it has not been generally introduced, simply because railroad managers know that headlights on road locomotives are practically useless, and that a more powerful light would be positively dangerous."

Mr. Toucey, general superintendent of the New York Central & Hudson River Railroad Company, says that "all that is simply nonsensical. The headlight is necessary, and this company recognizes that fact in its general rule that 'all trains and engines running after dark must display the white headlight in front of the engine.' As for that statement about the electric headlight, I am not aware that the electric headlight has ever been successfully applied for use on a locomotive. The oscillation and jarring of the engine would certainly have a tendency to throw the carbon points out of line, and that would stop the light. If that could be overcome there would be no ojection to its use in the fact of its greater brilliancy. It is not needed, however. The present light is brilliant enough, and is undoubtedly of service."

Mr. Wm. Buchanan, superintendent of motive power of the New York Central & Hudson River Railroad Company, said: "The road locomotive certainly needs a headlight when running into stations. And in going into and through a yard, where there are several tracks, it is necessary to enable the engineer to see ahead that his track is clear and the switches set rightly. He is then, of course, going at a reduced rate of speed and can stop if he sees anything wrong. While running on the road at full speed the headlight throws its rays on the track so as to illuminate it clearly 150 or 200 feet ahead. Seeing that far would not give the engineer time to come to a full stop before reaching a sighted obstruction, for it takes six or eight hundred feet to halt a heavy train, dependent, of course, upon the grade and condition of the track, the speed and the weight of the train; but it would give him time to slow up very considerably, and reduce danger. The headlight is useful in running through towns and villages, where speed is generally somewhat slackened, not only to enable the engineer to see what is ahead of him, but to give warning to persons on the track or near it, of the approach of a locomotive, and to signal gatemen to close the approaches to roads on the grade of the track. As for the illumination from the headlight obstructing sight of the switch lights, that is not true. I have been a locomotive engineer and know that it is not, and if I were going out again to run an engine at night, I am very sure that I would want a headlight. The colored switch lights are not in the line of white light thrown by the headlight, but to one side, and are seen clearly far beyond the limit that the headlight's rays reach. A red or green light can be distinguished a mile or a mile and a half away, while, as already said, the head light only reaches 150 or 200 feet clearly."

In response to a question whether the whistle of a locomotive could not advantageously be done away with, Mr. Buchanan replied in the negative. It would always, he thought, be needed, so long as there are grade crossings. The bell is not always sufficient to give warning of the approach of a train.—*New York Sun.*

Wear of Steel Rails.

THE *Revue Générale des Chemins de Fer* recently printed a paper by M. Coüard on the wear of steel rails. His observations have resulted in the following conclusions:—(1) that the wear is caused by the number of trains, more than by the tonnage, which passes over them; (2) that it is proportioned to the extent to which they can deflect when the wheels pass, and is therefore proportional, under similar circumstances, to the spacing of the cross-ties; (3) that with similar conditions of track and traffic, the higher the percentage of carbon, and of manganese, also, apparently, the better will the rail wear; (4) that with an in-

crease of hardness in the steel, and a greater rigidity under traffic, the wear diminishes correspondingly. The average composition of rails manufactured at the five large German works of Hörde, Krupp, Phœnix, Witkowitz and Reschitza was as follows: carbon, 0.31; manganese, 0.33; silicium, 0.08; phosphorus, 0.09; sulphur, 0.01, and copper, 0.14; the composition of rails from the Paris, Lyons & Mediterranean Railroad, which have shown a better wear than the above, averaged as follows: carbon, 0.83; manganese, 0.69; silicium, 0.15; phosphorus, nearly 0.05, and sulphur, 0.05. Although on German railroads the rolling stock is lighter and the speed of the trains slower than on French railroads, yet with equivalent conditions of track, the difference in the wear of the rails was found to be as 1 to 1.5 in favor of those manufactured in France. Other figures are given which show that on iron ties the wear is found to be greater than on those of wood. He states that in every case where the weight of the car-loads, and the speed of the trains is to be increased, the track must be laid with heavier rails, and the road-bed must be improved so as to render the track able to safely and economically carry the traffic under the new conditions.

Steepest Grades on French Railroads.

ACCORDING to a writer in a French industrial journal, the greatest inclination on any European railroad worked by ordinary locomotives is on the two miles between Enghein and Montmorency, near Paris, being forty-five feet in the thousand, or an angle of 2° 35′. Grades of thirty-five feet to the thousand, or 2°, are found on several roads. The grade of the Simplon road, the highway over the Alps with the least slope, is only 3° to the thousand, the maximum slope that can be traveled on a highway being set down as 132, or 7½°. The grades on cable or cogwheel railways are, of course, considerably greater; that of the road up the Swiss Rigi from Vitznau is, in the steepest part, 250 to the thousand, while the maximum on the Mount Washington Railway is estimated at 330 and 375, this latter being the steepest railway with a central toothed rail, and the steepest of any kind in the world, except the cable road up the cone of Mount Vesuvius, which has the extraordinary inclination of 630 to the thousand.

A Close System of Time-Keeping.

ACCORDING to the *Railway Reporter*, the Pennsylvania Railroad has been quietly building up a system of repairing locomotives and cars by contract that answers every requirement that the most enthusiastic advocate could require. They have left discussion out of the question and have put into actual practice a system that for the simplicity of its detail, the minuteness of its specifications, the effectiveness of its action and the general satisfaction that it gives to all the parties concerned, exceeds the bounds of what would once have been considered possible and demonstrates in the clearest manner its perfect practicability and desirability.

To perfect and develop such a system two things are required: honesty and strict attention to the cost under the system of daily wages. The last must receive the first attention. For years the rate of wages must be studied, and a system of time-keeping established that is minute in its particulars; the men must be required to give in each day the time occupied in every move they make. Not a bolt should be driven or a nut tightened up that does not receive the due charge of time that belongs to it. The bookkeepers must separate each item and classify and reclassify until some order seems to appear out of the chaos of data that flows in upon the office. Waste of time must be watched and the actual time expended in doing the work determined.

This careful watching must look to every detail. It must not only be known how long it takes to make the rocker-arm of an engine as a whole, but care must be taken to note the expense of each and every step, the time required to forge, to center, to lay off, to turn, to mill the edges, to chip or mill the bosses, to bore the pin holes, to ream them out, to bore the bushing, to fit the same, to case harden the same, to put it in position and connect the rod and links. Car details must be kept with equal strictness. The sills, for instance, must be watched with careful scrutiny. How long a time and how many men are required to carry the stick from the lumber pile to the planer, how long to face and dress it off, how long to lay it out, how long to cut the tenons, how long to bore the holes, and how long to put it in place.

A Yacht Propelled by the Explosion of Petroleum Vapor.

MESSRS. SAMUEL and JOHN SECOR, of Brooklyn, have had a yacht, 100 feet long, built at Poillon's shipyard. The motive power of this vessel is a modified form of gas engine, in which the gases resulting from the explosion of a mixture of air and petroleum vapor are made to impinge directly upon the water, through suitable port-holes beneath the surface. The *Scientific American* says: "When the motor was first started, the only results of the explosion were seen in the bubbling of the water at her stern; but as the machinery became heated, and the explosions more numerous and violent, the vessel moved forward with fairly smooth motion, and the gas came to the surface of the water in fine bubbles some distance from the stern. Considerable difficulty has been experienced in the vibrations produced when the first explosions take place and before the boat is under headway. But these have been greatly reduced, and it is not too much to hope that they can be entirely avoided when the mechanism is perfected. * * * There is at present very little ground upon which to calculate the probable economy of the vessel."

To the Adirondacks.

FORMERLY, the summer visitor to the Adirondacks took the train at the Grand Central Depot at 6.30 P. M., and arrived at Plattsburg about six the next morning. A correspondent of the *Evening Post* describes the old and the new routes as follows:—"At Plattsburg you took a wheezy little railway train for about ten miles to Ausable, and then a Concord coach upon which you were jolted for seven or eight hours over the forty miles between that point and either Saranac or Paul Smith's. Now the traveler can take his seat in a sleeper in the Grand Central Depot, and not leave the car until he reaches the end of the new rail-

way, which is only about eight miles from Paul Smith's and about twenty from Saranac. The car goes over the New York Central and Delaware & Hudson Canal Company's railways, as far as Rouse's Point, reaching there at 6.15 A. M. Here the sleeper is switched upon the Ogdensburg & Lake Champlain Railroad, going on that to a little station called Moira, a few miles beyond Malone. Then it is switched upon the Northern Adirondack Road. The region opened by the railway is said by the guides to be the best fishing and hunting ground in the Adirondacks. The railroad will, of course, drive the deer away, but the fish will remain. The conductor of the train was saying of a brook that we crossed that he could go down there at any time and take out all the three-pound trout that he wanted. Afterwards I asked the colored porter if he believed that story. 'Well, sah,' said he cautiously, 'I believe dey are dar, but I dunno' 'bout he takin' 'emout!'"

Novel Work for Railway Employés.

MR. MYLES MACINNESS, M.P., who is a director of the London & Northwestern Railway Company, addressed some 3,000 railway employés assembled recently at Exeter Hall on the occasion of the anniversary of the Railway Mission, and, in referring to the work of the mission with regard to temperance, reminded railway employés of the special opportunities they had of helping forward the social purity movement. He said: "We all can do something in the way of dealing with this evil. We each have our different opportunities, and you, as railway men, have your opportunities in a marked degree. You guards, think what you may do. Think how easily, and how, by a little watchful care on your part, some girl who is traveling alone in the train of which you have charge may be saved years of trouble. In such a case, watch over her and protect her. From time to time in the course of the journey see what companions she has. See who has left and who has joined her, and by so doing you may render her a service for which she will thank you to the end of time. You railway porters, who lead a busier life, think what you can do in this matter by a few kindly words and a little kindly advice to the girl who arrives forlorn and friendless at a station in a large town. Railway porters, who have girls of your own, think how you would like them to be watched and helped on their arriving, strange, unknown, and unprotected in a great town! You young men who are not yet married, and to whom I cannot appeal in that respect, greet every girl you see in a railway carriage, and on every crowded and busy platform, as you would wish your own sister to be greeted if she were traveling alone from the old home she had left."

Natural Gas for Locomotives.

THE Pennsylvania Railroad Company uses 6,000 tons of coal a day on its various lines, and is the largest consumer of soft coal in the country. It is now experimenting with natural gas as a fuel for its engines, and proposes, if the plan should prove to be feasible, to use gas on all the engines running into Pittsburgh. The *Commercial Gazette* says the Philadelphia Gas Company is laying a pipe into the Pittsburgh yard of the Pennsylvania Railroad Company, where a big reservoir is to be put up to supply the tanks of engines. The coal bill is one of the largest items of expense in running a railroad, an engine consuming nearly a bushel of coal per mile. If natural gas can be made available for this purpose the Pennsylvania Railroad Company will be able to run its locomotives on the Pittsburgh division more cheaply than the same mileage can be made with any other fuel. Engines will, of course, have to be furnished with tanks. These will be so arranged with compressors as to contain very large quantities of the gas, so that no accident or unexpected delay will be sufficient to so diminish the supply as to embarrass the movements of the engine. The experiments will be made this summer or early in the fall.—*Light, Heat and Power.*

Record of New Railroad Construction.

INFORMATION of the laying of track on new railroad lines is given in the current number of the *Railroad Gazette*, as follows:

Chicago, Burlington & Quincy.—The Geneva branch of this company's Burlington & Missouri River line is extended from Geneva, Neb., south to Strang, 10 miles.

Chicago, Burlington & Northern.—An increase of 18 miles at various points is reported.

Chicago, Evanston & Lake Superior.—Extended from Calvary, Ill., north to Evanston, 1½ miles.

Clearfield & Jefferson.—Track laid from Irvona, Pa., west to the Susquehanna river, 16 miles.

Dubuque & Northwestern.—Track laid from Hayfield, Ia., southward 10 miles.

Pittsburgh & Western.—The Narrow-Gauge Division is extended from Mount Jewett, Pa., northeast 6 miles.

St. Augustine & Palatka.—Completed from St. Augustine, Fla., southwest to the St. Johns river, opposite Palatka, Fla., 30 miles.

Southern Pacific.—The Northern Division track is laid to a point 15 miles southward from Soledad, Cal., an extension of 12½ miles.

This is a total of 104 miles on 8 lines, making in all 1,375 miles thus far reported for the current year. The new track reported to the corresponding date for 15 years has been:

	Miles.
1886	1,375
1885	864
1884	1,213
1883	2,109
1882	4,415
1881	2,281
1880	2,190
1879	1,008
1878	691
1877	689
1876	740
1875	426
1874	690
1873	1,518
1872	2,754

These figures include *main track only*, second or other additional tracks and sidings not being counted.

Molding Machines.

IN the Caledonian Railway Company's shops near Glasgow, a number of molding machines, capable of molding two hundred and fifty bushels of axle-boxes per day, are in operation. They were constructed in the works, and are worked by pressure of air supplied by a Westinghouse pump.

Caledonian Passenger-Car.

THE largest carriage now made for the Caledonian Railway is 36 feet long, in composites, chiefly of first and third class compartments, second-class having become unpopular; and vehicles of passenger trains are now all fitted with the Westinghouse brake, and the passengers' and conductors' compartments lighted with gas, while the former are now also being fitted with apparatus for their being heated by exhaust steam from the locomotive; and, in keeping with the philanthropic and humanizing tendencies of the age, a prison-car lately built in the works is fitted with gas, and provided with heating apparatus for providing hot coffee for the notorious voyagers.

Mileage in Europe.

AN American statistician has, by the aid of a French authority, secured the following estimate of the mileage of railroads in Europe on February 1st, 1885:

Germany	22,813
France	19,305
Great Britain and Ireland	18,949
Russia and Finland	15,767
Austria	13,727
Italy	6,163
Spain	5,379
Norway and Sweden	5,068
Belgium	2,682
Switzerland	1,714
Holland and Luxemburg	1,648
Denmark	1,207
Roumania	994
Portugal	948
Turkey, Bulgaria and Roumelia	865
Servia	151
Greece	14
Total in Europe	117,394
Total mileage United States, December 31st, 1884	125,379
Total mileage United States, December 31st, 1885	128,492

Widening Gauge on Curves.

AT a meeting of the "Institution of Permanent Way Inspectors" recently held in London, Mr. Golightly submitted the following scale, which was approved by a majority of the members:

Chains radius. *	Inches wide of normal gauge.
10	0
9½	1-16
9	⅛
8½	3-16
8	¼
7½	5-16
7	6-16
6½	7-16
6	½
5½	9-16
5	⅝
4½	11-16
4	¾

* The chain used in England is 66 feet.

Ballast.

AT a meeting of "Permanent Way Inspectors" recently held in London, Mr. Pinder (president) said that stone should not be used for ballast when other good ballast could be obtained. Mr. Golightly was in favor of granite chippings, by reason of its great freedom from clay. Another member thought that circumstances altered cases, and although stone might do for India, it caused more breakages in the sleepers in England than would a ballast composed of gravel.

THE Baldwin Locomotive Works recently completed and shipped engine numbered 8,000. The first locomotive built at these works was turned out in December, 1832, and it took 20 years—until November, 1852—to build 500 engines. The second 500 engines were built in 8 years, number 1,000 being finished in February, 1860. The next 6 years saw the third 500 built, number 1,500 leaving the shop in July, 1866. The fourth 500 were built in 3 years, by October 30th, 1869; the fifth 500 in 2 years, and the sixth and seventh 500 each in 1 year, engine number 3,500 leaving November 20th, 1873. Business then slackened, 3 years being required to build the next 500, and 2 years the following 500, engine number 4,500 leaving December 17th, 1878. Then trade improved, 500 engines being built in 15 months, and 1,000 more engines in 22 months, while 500 more engines were finished in 10 months, number 6,500 leaving December 6th, 1882, and marking a half century for the works. The next 8 months saw 500 more built, and before the close of 1884 number 7,500 was turned out. Work again slackened, and 19 months were required for the final 500 locomotives, number 8,000 having just left the establishment. It is noteworthy that one-half the whole number, and these by far the heaviest and most elaborate engines that have been built, were turned out within the last 10 years, the first 4,000 requiring 44 years to build.—*Philadelphia Ledger.*

COLUMBUS, O., is credited with having the model coaling station for locomotives in this country. It is connected with the new machine shops recently built by the Pittsburgh, Cincinnati & St. Louis Railroad Company at Columbus, O.; is operated by machinery specially designed for the work in the office of Mr. Wall, superintendent of motive power. It consists of an overhead traveling crane of ten tons capacity, which runs on a track on top of a trestle 24 feet high, 400 feet long, and distance between tracks 50 feet. It is operated by steam power, and works to perfection.

MR. JOHN W. CLOUD, engineer of tests on the Pennsylvania Railroad, has been appointed mechanical engineer. This is the position formerly occupied by the late Mr. Collin. The appointment dates from August 1st. The office of engineer of tests will, from that date, be merged into that of mechanical engineer, and the department of physical tests will be in charge of the mechanical engineer, who will make investigations, examine current supplies and materials to be purchased, and perform the other duties which pertain to that department.

THE Philadelphia & Reading Coal and Iron Company's shop at Reading, Pa., has just turned out engine No. 134, which bids fair to make or break a record. It was built for speed, and covered 50 miles in 48 minutes, including two stops. One mile was covered in 45 seconds.

IT is announced that the convention between the steel rail manufacturers of England, Belgium and Germany, formed for the purpose of preventing ruinous competition, has expired. It is stated that the convention will not be renewed.

AN official of the Cleveland Rolling Mill Company says: "We are now working to our fullest capacity on rails, and have orders ahead of us. The rails are for home trade, and are principally for use on western roads."

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Principal Contents of this Number.

AUTOMATIC COUPLERS.

A VALUED cotemporary has recently asked the question: "Why not have a test of car-couplers planned upon the same high scale as that to be occupied by the brake tests?" Previous attempts at determining the comparative merits of couplers, he says, have been failures, and he then enjoins railway mechanics as follows:

"It ought to be arranged—and we believe that it can—that all the coupler owners as confident of their merits as to dare to enter, should place their devices upon a given number of cars; place these cars in the hands of a carefully chosen committee; have the cars placed in every-day service and kept there for the requisite time; have these service tests carefully watched and recorded upon the thoroughly impartial basis obtaining in the brake tests; and have the whole affair planned, managed, recorded and reported in a broad, catholic spirit of fairness and justice—the whole so conducted as to reflect credit upon the world of railway mechanics."

What is said about the failure of the tests of couplers is not entirely correct, but there can be no question that thus far the investigations have not shown that any automatic coupler has sufficient merit to warrant its general adoption. The conclusions of the committees and commissions which have investigated this subject, have, thus far, been of a negative or tentative character. It may, therefore, be fairly questioned whether the methods which have been adopted for the investigation of this subject are adequate to the end proposed. Now, what is that end? In the article already quoted from the writer speaks of "determining the comparative merits of the various excellent couplers now before the market," and it has been very generally assumed that such a determination is the end to be accomplished.

But even if it was clearly shown which is the best coupler or couplers, if the best was not good enough, the "coupler question" would still be unsolved. In fact, the substance of the preliminary report of the executive committee of the Master Car-Builders' Association was that it had not been proved that any of the tested couplers were good enough to be recommended for general adoption. It is possible and, indeed, probable, that the work of this and other committees and commissions may consist simply of a process of elimination, and finally end in a report that none of the couplers tested fulfilled the requirements of practice.

In that event there would still be a demand for a coupler which would make it unnecessary for men to go between cars in coupling and uncoupling them. The problem, then, is to discover such a coupler which, in other respects, would be efficient and satisfactory.

It should be noted that the only kind of couplers which have thus far been submitted for trial are those which *are patented.* The reason of this is that, at present, no one has sufficient interest in any unpatented coupler to perfect it or have it tested or applied in practice.

It happens, too, and perhaps oftener than we know or think, that a device is patented and its merit is not recognized until after the expiration of the patent. The Allen slide-valve is an instance of that kind. It was not generally adopted in this country until it became public property. Other examples could be cited.

Further, it is probable that few persons who know how much time, money and labor must be expended in an effort to introduce an automatic coupler, and how very slight the chances are of success, would be willing to undertake the task. Doubtless, a great many inventors of couplers have abandoned the attempt to introduce them, and in doing so have acted wisely. Others may not have the money, or perhaps the capacity, to present the merits of their inventions, and they too allow their devices to slumber.

It should be remembered, too, that an inventor is interested alone in those features of his mechanism which he has patented. He will resist any change or substitution which endangers his "claims." Consequently his aim is not to evolve the best possible mechanism for accomplishing the end in view, but to prove that his particular "combination" is the best. Obviously, the attitude of mind of a person who is disinterestedly seeking for the most effective device for a given purpose, is very different from that of one who has a direct interest in showing that his invention is better than any other.

It follows, then that if the investigations are limited to "determining the comparative merits of various couplers before the market," that they will be confined to a portion only of those which are patented, and which some one is interested in introducing. All the ingenuity which has been exercised on expired patents, or by discouraged, impoverished or indifferent inventors will be ignored, and this important question will, to a very great extent, be left for solution with those who have axes to grind. Would any competent engineer or experienced mechanic undertake to solve any other analagous mechanical problem in such a way? If there was a bridge to build, in a position, or under conditions which entailed unusual difficulties, or a machine had to be constructed for a special purpose, would any able person, who has had experience in doing that kind of work, confine himself to patented plans submitted by their inventors? If he acted judiciously and prudently he would adopt whatever was most certain to accomplish his ends, whether it was old or new, giving a preference always to that which has been successfully used.

The whole question is essentially a mechanical one, and, therefore, it would seem as though mechanics would be much more likely to solve it than any other persons. If the railroad commissioners had questions of law or medicine to consider, they would not be likely to submit them to clergymen or shoemakers. When railroad companies become involved in disputes concerning their right to property or money, they are always ready to employ legal talent, and willing to pay for it in proportion to the amounts involved. When a lawyer is so employed his first step is to study all the facts and circumstances involved in the case, in the most thorough and minute way. No time or care is spared in searching for information concerning it, so that when the time for the trial arrives he will be able to give the judge and the jury all the information concerning it that is accessible. A similar course ought to be followed when a mechanica question of importance requires consideration; that is, some competent person should investigate the mechanical laws and facts concerned, as the lawyer studies the law and evidence in legal cases. Unfortunately, that is not always considered essential when some improved mechanism is needed. In such cases the value of mechanical knowledge, skill and experience is apt to be ignored, and frequently on such occasions an effort is made to evolve improvement by counting noses, which often belong to a class which has very little keenness of scent in mechanical research.

It does not seem at all probable that a satisfactory automatic coupler will be evolved excepting through the efforts of some one competent person, who is ingenious and is a master of mechanical design, and who has withal that clear judgment that can discern those appliances which will be effective from those which will not be.

The effort to have, mechanical inventions or designs made through the instrumentality of a committee or a commission has thus far not been very successful, and does not appear likely to be any more so in the case of automatic couplers.

POVERTY TO BE ABOLISHED.

At a large public meeting of Knights of Labor held in Union Square, on Saturday night, July 31st, one of the principal speakers announced that the object of the Knights was to abolish poverty! This is certainly a very desirable end to be attained, but how do they propose to do it? To prohibit worthy people from earning an honest living does not seem to those not initiated into the mysteries of Knighthood, a very logical way of accomplishing the end proposed.

EDITORIAL NOTES.

The Burlington brake tests, it was expected, would be concluded on Saturday, July 30th. Thus far it appears to have been conclusively shown that, with trains of 50 cars, the buffer brakes, that is, brakes which are operated by the compression of the draw-bars or buffers, have not worked satisfactorily, on account of the violent and re-

peated shocks produced in the rear cars of the train. It remains with the inventors and owners of those brakes to show whether this difficulty can be remedied.

With the meager and somewhat confused data thus far received, it is impossible to draw any deductions without danger of doing injustice to some of the contestants. The following table gives the speed, and the distance in which trains of 50 empty cars were stopped by the Westinghouse and the Eames brakes:

EAMES BRAKE.		WESTINGHOUSE BRAKE.	
Speed, miles per hour, at time brakes were applied.	Feet run after applying brakes.	Speed, miles per hour, at time brakes were applied.	Feet run after applying brakes.
20	414	20½	354
22	437	23	431
22	448	23	424
22½	497	23	427
*30	1,442	40	922
38	1,055	40½	927
38	1,016	43	1,104
40	1,399	43	1,116

* A car was disabled in this test, preventing accurate time being taken for the stop.

These were emergency stops, that is, the train was stopped in the shortest distance possible, and, it is said, caused a great shaking up in the caboose car.

The report of the committee in charge of these tests will be looked for with much interest.

* * *

THE time-table of the Western Division of the Canadian Pacific Railway appears in the August number of the "Travelers' Official Railway Guide," with the hours shown according to the "twenty-four o'clock" use. The employés time-table for the same road, which took effect on June 27th, is the first of the character that has ever been printed for actual use by railway employés.

Report of the Fourth Annual Meeting of the American Street-Railway Association.

THIS is a very neatly printed volume of over 200 pages, which needs only an index to make it very complete. It contains a portrait of the president of the association, Mr. Calvin A. Richards, who is also president of the Metropolitan Railroad Company, of Boston. Besides a report of the regular routine business, such as the roll-call, secretary's and treasurer's reports, etc., the volume contains reports of committees on "Diseases Common to Car Horses and their Treatment," on the "Progress of Electricity as a Motive Power," on "Repairs of Track," on the "Progress of the Cable Systems of Motive Power," on "Rules Governing Conductors and Drivers," on "Taxation and License," and a letter from the chairman of the committee on "Ventilation, Lighting and Care of Cars." Besides this there is a verbatim report of the discussion of these reports, and a paper read before the National Electric Medical Association by A. B. Whitney, M. D., on "Salting of Streets after Snow-Storms."

The volume is well printed on good paper, but the absence of an index is inexcusable. Making an index is very tiresome and uninteresting work, but, nevertheless, in these busy days, no book should be published without one.

Street-Railways.

American Street-Railway Association.

President.—Julius S. Walsh, President Citizens' Railway Company, St. Louis, Mo.

First Vice-President.—William White, President Dry Dock, East Broadway and Battery Railroad Company, New York City.

Second Vice-President.—C. B. Holmes, President Chicago City Railway Company, Chicago, Ill.

Third Vice-President.—Samuel Little, Treasurer Highland Street-Railway Company, Boston, Mass.

Secretary and Treasurer.—William J. Richardson, Secretary Atlantic Avenue Railroad Company, Brooklyn, N. Y.

Office of the Association, cor. Atlantic and Third Avenues, Brooklyn, N.Y.

The Fifth Annual Convention of the Association will meet in Cincinnati, O., on Wednesday, October 20th, 1886.

THE CABLE SYSTEM FOR STREET-RAILROADS.

THE cable system, instead of being a recent invention, as is often supposed, really antedates the locomotive and is older apparently than the earliest railroads. "Wood's Treatise on Railroads" (third edition, 1838), contains the following historical account of the use of the cable system:

"The first introduction of inclined planes, wherever the gravity of a heavy body downwards was employed to assist, or effect, the moving of a less heavy body up a plane, inclined to the horizon, appears to have been upon canals, where the weight of the loaded boats, lowered down, was made to draw the empty boats up a sloping plane, from one level to another.

"In the year 1788, Mr. REYNOLDS completed, at the Ketley Iron Works, an inclined plane, formed of a double iron railroad, by which a loaded boat, in passing down a frame, constructed for the purpose, drew up the boats which were empty. Since that time, many inclined planes have been made upon railroads, for the purpose of drawing up the empty carriages, by the gravitating power of the loaded carriages down the plane."

In another place the author says:

"The practice of dragging boats upon canals from one level to another, to save lockage water, by means of sloping planes, has long been in use; but the introduction of steam engines to drag carriages up ascending planes upon railroads is comparatively recent. Mr. S. COOKE, in 1808, erected an engine upon Birtley Fell, in the county of Durham, to draw the loaded carriages of the Urpetts Colliery, across the Durham and Newcastle turnpike road, up a steep ascent; and since that time they have been much used upon the railroads in the neighborhood of Newcastle."

The same author gives a description and illustration of the plan of an endless rope adopted by Mr. STEPHENSON on the Liverpool and Manchester Railway, which terminated at the Liverpool end, at a high level, and it was therefore necessary to apply a fixed engine to drag the goods up from the low level or station, near the docks, to the higher level.

In 1829, Messrs. WALKER and RASTRICK were requested by the directors of the Liverpool & Manchester Railway, to undertake "a journey to Darlington and the neighborhood of Newcastle; to inspect the different railways in those districts, and to ascertain, by a thorough investigation into the power of the engines, the cost of working them, and their actual performances, the comparative

merits of the two descriptions of moving power." These gentlemen made a report in which they estimated that it would cost 0.2134 of a penny per ton per mile, to convey 4,000 tons of "goods and merchandise" 30 miles per day, for 312 days, by means of stationary engines and ropes, and 0.2787 of a penny per ton per mile with locomotive engines. They, therefore, favored the adoption of the rope system of traction.

The publication of this report, led Messrs. ROBERT STEPHENSON and JOSEPH LOCKE to make an examination of the correctness of the calculation and conclusions, and they reported that the cost of transportation with locomotive engines would be 0.164 of a penny per mile. Mr. WOOD remarks that the fundamental difference arises from the increase of power effected in the construction of the locomotive engines *since* the estimates of Messrs. WALKER and RASTRICK were formed, so that even in those early days, the influence of an increase of train load on the cost of transportation was made apparent.

The cable system has been extensively used on steep inclines ever since the early days of the Liverpool & Manchester Railway. It is only recently that cable traction has been employed on lines which are level, or which have comparatively light grades. Many residents of New York remember the experiments of Mr. HARVEY with the cable system on the old Greenwich Street Elevated Railroad. These were not successful, and the cable was displaced by light locomotives.

In 1856, Mr. JAMES GARDINER, of Philadelphia, patented the combination of an underground tube containing a moving cable and wheels for its support, the tube communicating by means of a slot with the surface. In 1873, Mr. HALLIDIE built the Clay Street Hill Railroad in San Francisco. It was on this line that the details of the GARDINER tube, and the grip and car mechanism were successfully applied to street traffic. Since then, and especially within the past five years, the system has been adopted and introduced in many widely separated localities, and seems destined to supersede horse power on many lines with sufficient traffic to justify the first outlay for the fixed plant.

The difficulty now seems to be the same that was encountered when WOOD wrote his treatise, that is, the wear of the ropes. The "mean average cost of ropes" was in one case then found to be .05 of a penny per ton of goods per mile. In another it was estimated at .08 of a penny.

In the discussion which followed the reading of a report on this subject, at the last annual meeting of the American Street-Railway Association, one of the speakers said that the first cable put in the Valencia street line of the Market Street Cable Railway, San Francisco, lasted 25 months. It was 1¼ inch diameter. Cars ran every three minutes. The life of the Sutter street cable, the same speaker said, was 18 months, and the Clay street cable, two years; but the cars and traffic on the latter line are both light. He expressed the opinion that a street cable properly made and spliced will last twelve months.

Doubtless, much will be done in the future to lengthen the life of cables, and to improve the system in other directions. With the competing claims of steam and gas engines, electricity, compressed air and other motors, it would at present be rash, though, to predict what the future locomotive power on street-railroads will be.

THE backers of the Arcade Railway are again making themselves heard. There is a vast quantity of preliminary work to be done before the actual operations are got under way. In the present days of legislatorial interest in all public enterprises it is no small job to satisfy each incorruptible guardian of the people's welfare that all is as it should be. Occasionally, moreover, there is more or less expense attending that interesting operation. The cause is good, however, and, therefore, may results be better.

* * *

THERE is a popular hallucination on the part of horse owners that the useful animals who act as motive power on our various local car-lines are hideously ill-treated and overworked. A greater error was never popular. If the owners of working horse-flesh generally used but half the care and consideration shown to car-horses, the equine tables of mortality would warrant a much lower insurance rate upon their valuable lives.

* * *

THE present condition of horse-car interests seems to represent rather the calm *after* the storm. It is, at least, to be sincerely trusted that it does not presage the well-known quiet of the ancient saw, for surely there has been storm enough; and, while there is no hoary adage to justify peace after war, experience has shown that it generally follows, and may experience, in this case at least, be right

* * *

AT every slight accident on the elevated railroads, whether from fog or what-not, there is more or less outcry of "bad management." The only wonder is, the almost miraculous freedom from disaster from the first. When one reflects upon the care required to safely handle the enormous number of trains passing over the roads each day, he is lost in respectful amazement, and only marvels that the structures have not been knocked down long since.

Another Electric Car Motor.

THE *Philadelphia Record* describes a trial of another new electric motor, of which it says: "The electric-motor car of the Union Electric Company was given a very successful test last evening on the tracks of the Ridge

Avenue Line above the depot of the company at Dauphin street. The demonstration was made in the presence of a large number of scientists and other distinguished gentlemen, who pronounced it a thorough success. The electrician of the road, William M. Schlessinger, and his assistant, Henry Clay, Jr., have been working hard to perfect the machinery since the car was first placed on the road last fall, and it has now reached their expectations. The car last evening made several trips. On each occasion it was loaded with passengers, and the motor worked without a flaw. Loaded with passengers, it was moved along at the rate of nearly eight miles an hour, and without any perceptible jerks. It was stopped and reversed at the will of the engineer.

"The electric power is generated by an eight-horse power dynamo in the depot, and is supplied to the motor under the car through copper conductors placed in a slot in the middle of the track. A 'traveler' is arranged in this opening, through which the current is conveyed to the motor from the rail. The car can be moved either forward or backward, and, by the same lever which governs the motion, it can be stopped without the use of a brake. A safety-brake is, however, provided, by which it can be stopped in its own length. The vehicle is lighted by six electric lamps. The cost of operation is less then one-half of that of horse power."

Is it not a little early to make so positive a declaration of the economy of this motor?

Broadway Railroad Earnings.

THE showing of the Broadway and Seventh Avenue Railroad Company, of New York, in their report for the quarter ending June 30, is peculiar. It shows an enormous increase in its earnings of $167,551.76, and a decrease in its net profits of $32,040.13. The operating expenses of 1885 were $152,277.60; for the same quarter it was $282,719.47 this year. Was this increase of $130,441.87 to help Jake Sharp in his defence, or was it legitimate? is a pertinent question. For the quarters ending June 30, 1885 and 1886, the report shows:—

	1885.	1886.
Gross earnings from operation	$259,520 50	$427,072 26
Operating expenses, excluding all taxes	152,277 60	282,719 47
Rentals		54,687 00
Gross income from all sources	108,017 90	147,352 79
Net income from all sources	75,905 92	43,865 79

The balance-sheet shows the cost of the road to be $4,489,242.01; capital stock, $2,100,000; funded debt, $2,200,000; loans and bills payable, $122,638.39; profit and loss surplus, $82,300.49.

Rasping and Greasing Horses' Hoofs.

THE horse is one of the most superbly perfect of nature's works, viewed physically; and he occupies besides an exalted position among animals as to his intelligent moral qualities. It is, therefore, most painful to see how, under the handling of intelligent (?) man, he is maltreated and even abused. He submits his neck to the yoke uncomplainingly; he accepts the iron-plating of his feet, and he allows the galling check upon the movements of his head, and yet gives man his best service even to the death. The ignorant smith has his views as to what should be the shape of his feet; so he cuts and rasps, and forms them to suit himself. He has an idea that the hoof is made on purpose for him to rasp and shoe, and exercise all the tools of his trade upon. So he makes a shoe and fits the hoof to it; he removes the natural polished exterior, which by its tough elasticity defends the tender parts from injury, is nearly impervious to water, and permits a little evaporation of internal moisture, by which it is kept normally pliable and vitalized to the very surface. He rounds and smooths off the new surface; leaves it in a condition to allow the moisture of the hoof to pass off rapidly, and the hoof to dry and crack; and thus he recommends the application of tar and grease and lampblack, as if he were trying to render an old boot pliable and presentable. The greasing may be well enough—better than nothing—after the mischief is done. But why do sensible horse owners allow the evil which their peremptory orders, if not their mere remonstrances, would prevent?—*Ex.*

Proposed Consolidated Cable Roads in St. Louis.

IT is reported that a movement to unite all of the street-railway companies of St. Louis under one management, with a trust board at the head of affairs, is on foot. The plan is said to have been suggested as one of mutual protection against excessive competition and a resulting cut in fares, the directors of some of the older ones believing that a remunerative business can be carried on by reducing the fare from five to three cents. A committee has been appointed to ascertain if the scheme is practicable, and they have agreed to report, it is believed, favorably.

Mr. S. H. Terry of Chicago, the inventor of a new grip and cable system, was before the committee last night at the latter's invitation, and explained to them the merits of the system, which makes possible a cable line twenty miles long, of four systems operated by one plant. If satisfactory arrangements can be made by the committee for the purchase of the patent, and if the proposed consolidation can be brought about, horse power will be done away with, and every street-car in the city will be moved by the cable.

STREET-RAILWAY NEWS.

ALABAMA.

AT Birmingham the Western Valley Street-Railway Company has been incorporated. The capital stock is $50,000.

COLORADO.

The Denver City Railway Company will build new lines from Seventeenth to Humboldt street, the lines will be double-tracked. The company are enlarging their stable accommodation.

DAKOTA.

At Sioux Falls a street-railway is projected, and is expected that some steps will soon be taken to have the road built.

FLORIDA.

At Sanford a movement is on foot to establish a street-railway.

At Gainesville a company is being worked up to build a street-railway.

ILLINOIS.

The Hyde Park Board of Trustees have passed an ordinance granting the right-of-way to the Cook County Rapid Transit Company. The line will run from 41st street to the right-of-way of the Chicago and Western Indiana Railroad, and along that road to the Indiana State line.

An elevated railroad for Chicago is being talked of and seems in a fair way to be constructed. J. D. Jennings, of the South Side, and Mr. Huidekooper, of Philadelphia, are among the interested parties

The Haines Car-Starter Company has been incorporated at Chicago with a capital stock of $200,000.

The Chicago Suburban Transit Company has been incorporated by John Tomlinson and others. Capital, $5,000,000.

The West Division Street-Railway, of Chicago, has its cars now running over the new viaduct at Halstead street, and will extend its service to Leavitt street. The new line will run down Leavitt street until the completion of the Eighteenth street line.

The ordinance granting the La Salle street tunnel to the North Side City Railway, of Chicago, has been passed. The mayor vetoed the original ordinance, but signed one, which has been accepted, giving more benefits to the city. The railway company is to erect two bridges, keep the tunnel in repair, and pay a yearly rental for the latter.

At Chicago the Cross-Town Passenger Railway Company has been organized with a capital of $1,000,000. The line will cross the river at Taylor street, where the city is expected to pay half the cost of the bridge and approaches and run along Dearborn to Twenty-second and State streets. The road will be about 8 miles long. Over $35,000 of stock has been subscribed for.

KANSAS.

The street-railway company at Winfield has placed orders in St. Louis for the rails and cars for the new road. About two and a half miles of track will be built this season.

MASSACHUSETTS.

No injunction has yet been issued against the North Adams Street-Railway Company, though there has been considerable talk of such a proceeding. There is a more favorable feeling now being evinced towards the line and there is a disposition to wait and see if any actual harm is done before hampering the project.

The Winthrop Electric Street-Railway Company has been incorporated to build a line from Winthrop Junction to Point Shirley. Erastus H. Doolittle, Walter Lawton and others are the incorporators.

At Lawrence a company has been incorporated to build electric engines for street-railways. Capital stock, $1,000,000.

The New Bedford & Fair Haven Horse Railway Company recently made an application to Justice Barrett, in the Supreme Court, for a temporary injuction to restrain the Acushnet Railway from using the plaintiff company's track in New Bedford, pursuant to an order granted by the mayor; which order the company claimed to be invalid. The injunction was refused.

The $20,000 stock of the West Springfield Horse Railway has been taken up. The cars are expected to be running in three months. The line will run from the intersection of Main and East Bridge streets to the Boston & Albany depot. A foot-bridge is to be thrown across the Agawan river to attract Agawan traffic.

The Fitchburg Street-Railway has been opened. The first trip was made by the city officials and the directors.

MINNESOTA.

On the Minneapolis, Lyndale & Minnetonka Railroad an electric motor, on the Van Depoele system, hauls the cars from the city terminus to the city line, whence they are hauled by dummies as usual, steam dummies having recently been prohibited from being run on the streets. The cars are similar to those on the New York elevated railways. Five or six heavily loaded open cars are hauled with ease, and the working by electricity proves a success.

MISSOURI.

The Kansas City Electric Railway Company has been incorporated by W. W. Kendall and others. Capital, $10,000.

The Corrigan Street-Railway, of Kansas City, has been sold to Col. C. F. Moore, representing a new company. The company will construct cable lines on Fifth and Twelfth streets.

NEW YORK.

The Third Avenue Railway Company, New York City, will convert its line to the cable system as soon as the necessary arrangements can be made. From experience with the Tenth avenue cable line the change is expected to effect a great economy in operating expenses.

A street railway will soon be built on First street, Fulton, N. Y., to connect Midland & Delaware, Lackawanna & Western depots. It will be double track.

President Richardson has been granted permission to build a cable line on Park avenue, Brooklyn. The tubes will be laid this season on the mile and a half section from Washington street to Broadway, and if this proves a success the five miles will be completed next spring.

A. H. Matheaius has obtained a franchise for a cable road, to be built on his system, in Brooklyn, from Wall Street Ferry to the City Hall.

OHIO.

The Citizens' Street-Railway Company, Springfield, O., will construct a line on East High street to East Springfield; and another on North Plum street to Ferncliff Cemetery.

The Cincinnati Elevated Railway Company proposes to build a line and has applied for a charter. The incorporators are: Eugene Zimmerman, M. E. Ingalls, L. Maxwell and others.

SOUTH CAROLINA.

Work has been commenced on the Columbia Street-Railway, and cars will be running by the middle of September.

TENNESSEE.

The Madison Street-Railway, of Clarksville, is completed; it was said that the people were too poor to ride, and that the scheme would never pay; as it proves, however, the cars can hardly run fast enough to accommodate the traffic. The line was commenced six months ago, and extensions are projected.

Manufactures.

THE ROGERS LOCOMOTIVE AND MACHINE WORKS.

(Continued from page 133.)

CHAPTER IV.

HISTORY OF LOCOMOTIVE BUILDING AT THE ROGERS LOCOMOTIVE AND MACHINE WORKS.

PREPARATION for locomotive building in Paterson had been made as early as 1833 by Messrs. Paul & Beggs, in their shop near that of Mr. Rogers. They had a small engine nearly completed when their building took fire and was consumed, and the locomotive destroyed.

In 1835 some buildings were begun by Messrs. Rogers, Ketchum & Grosvenor, with a view to the manufacture of locomotives.

The first locomotive, the "Sandusky," Fig. 12, which the firm built, was not completed until 1837. It was intended for the New Jersey Railroad & Transportation Company. The engine was 4 feet 10 inches gauge, the same as that of the line for which it was built. It had cylinders 11 inches diameter by 16 inches stroke, with one

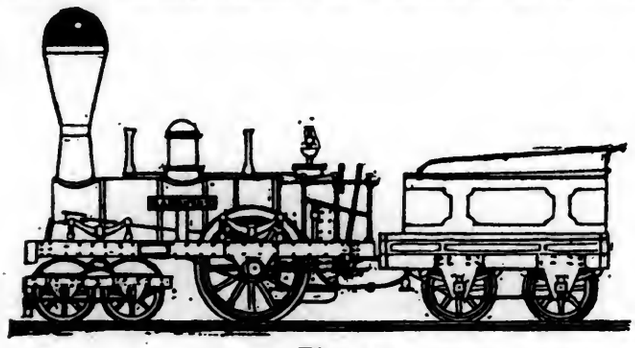


Fig. 12.

pair of driving-wheels of 4 feet 6 inches diameter, which were placed in front of the fire-box. The engine had a truck in front with four 30-inch wheels. The cylinders were inside the frames and were connected to a crank-axle of the form shown in Fig. 13. The eccentrics were outside of the frame, and the eccentric rods extended back to rocking shafts which were located under the foot-board. The smoke-pipe was of the bonnet kind, and had a deflecting cone in its centre. The edges of the cone were curled over so as to deflect the sparks downward, and thus prevent their passing through the wire bonnet, as well as preventing the bonnets from wearing out too fast.

The driving-wheels of the engine were made of cast-iron, with hollow spokes and rims, which at the time was a remarkable novelty. The section of the spokes was of an oval form, and the rim of very much the same shape as that which is in common use at the present time. This kind of driving-wheel has since come into almost universal use in this country.

Another important improvement adopted by Mr. Rogers in the construction of this engine, was the counterbalancing the weight of the crank, connecting rods and piston. For this he filed a specification in the Patent Office, dated July 12th, 1837. It is described as follows in the specification:

"The nature of my improvement consists in providing the section of the wheel opposite to the crank with sufficient weight to counterbalance the crank and connecting rods, making the resistance of the engine less in starting and in running; also preventing the irregularity of motion caused by that side of the wheels when the cranks are placed in the usual mode of fitting them up. The irregular motion which arises from not having the cranks and connecting rods balanced, is attended with much injury to the engine, and to the road, and with much loss of power."

In order to counterbalance the weight of the parts referred to, the rim of the wheel opposite the crank was cast solid, while the other part of it was made hollow. The importance of counterbalancing was not recognized as being necessary until several years after it had been introduced by Mr. Rogers, and when attention was drawn to it, many doubted the necessity of balancing anything more than the cranks.

The trial trip of the "Sandusky" was made from Paterson to Jersey City and New Brunswick, and back, on the 6th of October, 1837, Mr. Timothy Smith acting as engineer. The performance of the engine was entirely satisfactory; the gauge of the road was 4 feet 10 inches, the

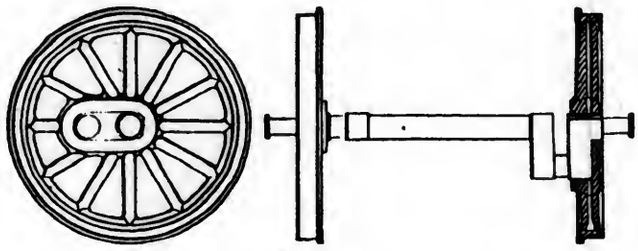


Fig. 13.

same as that of the New Jersey Railroad & Transportation Company, for which road the engine was intended. It was, however, bought for the Mad River & Lake Erie Railroad by its President, Mr. J. H. James, of Urbana, Ohio, and, on the 14th, it was shipped via canal and lake, in charge of Mr. Thomas Hogg, in the schooner *Sandusky*. Mr. Hogg had worked upon it from the commencement. It arrived at Sandusky, November 17th, 1837, at which time not a foot of track had been laid. The road was built to suit the gauge of the engine, and the Legislature of Ohio passed an Act requiring all roads built in that State to be of 4 feet 10 inches gauge, the same as the engine "Sandusky."

The engine was used in the construction of the road until the 11th of April, 1838, when regular trips for the conveyance of passengers commenced between Belleview and Sandusky, a distance of 16 miles.

The engineer was Thomas Hogg, who ran the engine for three years, keeping it in repair. It continued in service many years, until engines of larger size were required to do the work.

The second locomotive built by Mr. Rogers was called the "Arresseoh No. 2." It was completed in February, 1838, for the New Jersey Railroad & Transportation Company. It was similar in design to the "Sandusky."

The third engine was named the "Clinton," and was built for the Lockport & Niagara Falls Railroad Company, and was delivered to it in April, 1838. It differed from the first engines in having cylinders which were 10 inches in diameter and 18 inches stroke, and the gauge was 4 feet 8½ inches. Both the driving and the truck wheels of this engine had hollow oval spokes and hollow rims with wrought-iron tires. This engine was run by Wm. E. Cooper until November, 1843, when it was sold to the

Toledo & Adrian Railroad for $6,500, the original cost. It was said by Mr. Cooper that when the engine was sold it was considered to be one of the best working engines in existence.

An engine called the "Experiment," was the next or the fourth locomotive turned out. It was made for the South Carolina Railroad, and was delivered in June, 1838. This engine differed from those previously built at these works, in having a smaller cylinder and longer stroke than usual.

The "Sandusky" was the type of the first four locomotives built by Messrs. Rogers, Ketchum & Grosvenor. In many respects they all resembled the Stephenson engines. They had inside cylinders and a crank-axle, but differed from English locomotives chiefly in having a truck instead of a pair of leading wheels. The driving-axles were in front of the fire-boxes, with the result that the overhang of the latter behind the axle brought an undue proportion of the weight of the engine on these axles.

To remedy the evil of an excessive amount of weight on the driving-axle the latter was placed behind the fire-box in the fifth engine, called the "Batavia," Fig. 14, built at these works. When this was done, however, there

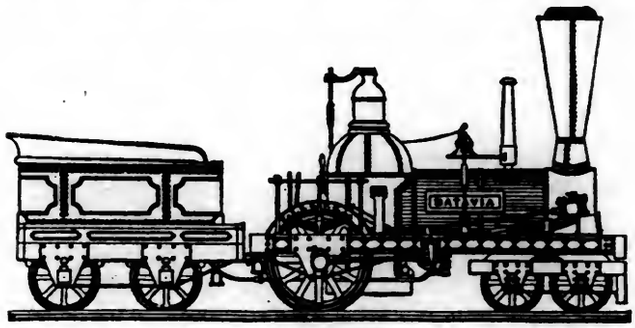


Fig. 14.

was too little load on the driving-wheels, and an arrangement was provided for transferring part of the weight of the tender to them. The "Batavia" was built for the Tonawanda Railroad, and was completed in 1838. The shape of the furnace, in plan, was semi-circular at the rear part, and it had a hemispherical top surmounted with a dome. This form of fire-box was used as late as 1857.

In his early engines, besides using inside cylinders, Mr. Rogers also followed the plan which is still used in England, viz.: putting the cranks for parallel or coupling rods opposite to the main cranks. He soon found that this arrangement, while it had some advantages, such as requiring less counterbalance, caused the journals of the driving-axles to wear oval; he therefore adopted the plan of putting the cranks for both main and outside rods, on the same side of the center of the axle.

The "state of the art" of locomotive building in this country in its infancy is graphically described in the following articles, which appeared in the AMERICAN RAILROAD JOURNAL AND MECHANIC'S MAGAZINE of December 15th, 1839. In one of these the editor said:

"A few days ago, in company with one of the proprietors, we had the pleasure of a visit to, and inspection of the very extensive works of Messrs. Rogers, Ketchum & Grosvenor, at Paterson, New Jersey, for the construction of various kinds of machinery. Our attention was, of course, principally directed to the shops for the construction of locomotives, the main building of which is 200 feet long and three stories high, and another of equal length containing near 50 forges, most of which were in operation, notwithstanding the pressure of the times.

"We saw a number of engines in different states of forwardness, and though the general forms are those of 6-wheeled American engines in general, we were not a little gratified with several minor arrangements, new to us at least, which have been introduced by Mr. Rogers, and to which we shall briefly refer.

"The wire gauze of the smoke-pipe is protected by an inverted cone, placed in the axis of the pipe, a few inches below the wire gauze. The base of the cone is curled over so as to scatter the sparks over a large portion of the surface of the wire cloth, and to prevent the top of the spark-catcher from being burnt out before the rest of the wire cloth is materially injured; it also tends to throw the larger sparks down between the pipe and the casing, and will do something towards diminishing this standing reproach.

"The truck-frames, whether of wood or iron, were admirably stiffened by diagonal braces, and where the crank-axle is used, the large frame is very strongly plated in the manner of Stephenson's engines, the neglect of which till very lately has been, we are informed, a constant objection to the Philadelphia engines on the Long Island and Troy railroads.

"The wheels are of cast-iron, with wrought-iron tires; the spokes are round, and they, as well as the rims, are hollow, except where the crank-axle is used, when the rims are cast solid on one side so as to counterbalance the cranks.

"Our readers will probably remember an article on this subject in the JOURNAL, Nos. 7 and 8, page 244, of the present volume, on 'Side Motion or Rocking,' by G. Heaton, where its success on the Birmingham Railroad has been complete.

"Mr. Rogers balanced his first engine-wheels two and a half years since, and entered a specification, not with the intention of taking out a patent, but to prevent anyone else from doing so; and thus deprive the community of the benefit which Mr. Rogers was desirous of conferring, and which we understand other makers are now availing themselves of. The advantages are fully explained in the article referred to.

"When the crank-axle is used, the eccentric rods and the cranks of the rock-shafts are placed on the outside, where they are easily got at, and where they are not crowded into the smallest possible space, as with the ordinary arrangement. For this, also, a specification was entered with the same object as in the preceding case.

"But we were most pleased with the arrangement of levers to which the eccentric rods are fastened, and thus the reversing depends on no contingency, for the rods are forced in and out of gear; a single handle only is required to manage the engine much more rapidly and efficiently than by the ordinary mode. The boilers are 8 feet long, for an 8-ton engine, and with 120 flues, the usual length of the former being, we believe, 7 feet, and the number of the latter about 80 or 90; by this deviation the area of heating surface is increased, and the heat remains longer in contact with the flues, while the addition to the weight is very trifling compared with the advantages derived from the saving of fuel.

"Mr. Baldwin, of Philadelphia, took out a patent some time since for a very ingenious mode of saving half the crank, by inserting the wrists into one of the spokes of the driving-wheels, and this has been very closely imitated by making one complete crank, and by letting one-half of it into a spoke which is cast larger than the others, with a receptacle for the purpose. This latter plan has been adopted by Mr. Rogers and others in this neighborhood, whilst the Boston machinists aim at bringing the two cranks as near together as possible. The relative merits of straight and cranked axles are so well pointed out in Mr. Wood's papers on locomotives in these numbers, that we shall merely beg leave to state that the plan of Mr. Baldwin and its imitation, appear to us to combine the liability to fracture of the crank-axle with the loss of heat, the exposure to accident, and the racking of frame and road ascribed to the straight axle, for the only difference is the thickness of the spoke, the loss of heat is the same in both, the protection against any serious accident is too trifling to be considered, whilst, with the cranks as close together as possible, the cylinders are completely protected.

"We offer these remarks as our views merely, and with all due deference to the superior skill of Messrs. Baldwin and Rogers. Mr. Rogers, in common with all other experienced machinists with whom we have conversed, is decidedly opposed to any increase of width of track beyond 5 feet, with the present weight of engine.

"As regards the power of the engines, they are able to slip the wheels when the rails are in the best state; this they do in common with all good American or English engines, consequently any accounts of extraordinary performance would be worse than superfluous, when we know that they will do all that any other engine whatever, with the same weight on the driving-wheels, possibly can do.

"As a last remark, we would observe, that there is more finish on the engines of Messrs. Rogers, Ketchum & Grosvenor than we are in the habit of seeing; some parts usually painted black being highly polished. On the whole we consider their new establishment eminently calculated to add to the reputation of American locomotives, as it has for many years largely contributed to the character of American machinery for the manufacture of cotton and other objects."

(To be continued.)

New Inventions.

Wheeler's Nut-Lock.

MERRITT P. WHEELER, of Winnebago Agency, Nebraska, is the inventor of a new and improved form of nut-lock, which is herewith illustrated and described. The object of this improvement is a device for securely locking nuts on bolts, that can be conveniently and quickly adjusted for tightening or removing the nuts and bolts as occasion may require. These results are attainable by the mechanism illustrated in the drawings herewith as part hereof, in which the same letters of reference denote the same parts in the different views.

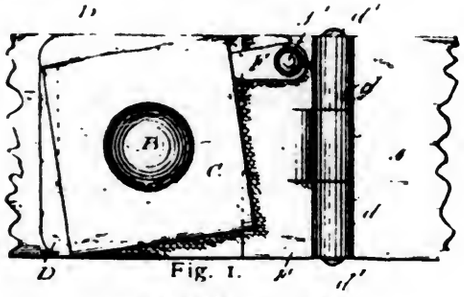


Fig. 1.

WHEELER'S NUT-LOCK.

In the accompanying cuts, Fig. 1 is a plan view of a nut-lock embodying the features of the improvement. Fig. 2 is a side elevation of the same. Fig. 3 is a representation of the nut inverted, and Fig. 4 a side view of one of the parts detached.

A represents a part of a machine or other object to which the bolt may be attached. B is the bolt, C is the nut, having its lower side diagonally cut away at its corners, as shown at *c*. D is an oblong washer provided with eyes *d*.

E is a plate hinged to the washer D, by a pintle *d'*. The hinged plate E, has a straight end or edge, and is

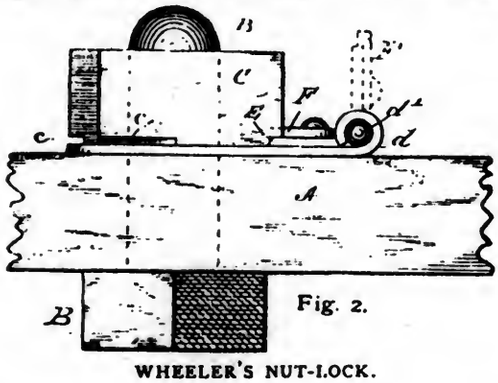


Fig. 2.

WHEELER'S NUT-LOCK.

extended from the washer-eyes *d*, sufficiently to exactly meet the side of the nut when it is in a position on the bolt to be square with the washer D.

F is a key pivotally secured to the plate E, by a rivet or otherwise, as shown at *f'*. The key F, is provided at its end with a down-flange *f*, slightly extended below the top edge of the plate E, for a purpose hereinafter set forth.

In the application of the device, the bolt is set through the washer, the hinged plate of which is first given an elevated position to clear the nut, as indicated by the dotted profile lines in Fig. 2. The nut is then applied to the bolt and screwed tight against the object on which the bolt is used, with its side nearest the plate E, square with the edge of the latter when in the position shown in Fig. 4. The plate E, is then lowered and the nut turned back until its corner projects over and its diagonally-cut part engages with the edge of the plate E. The hinged key F, is then adjusted in a circular direction until its flanged end *f*, drops or springs over the edge of the plate E, and between the same and the side of the nut, as shown. The nut will thus be secured against movement in either direction. When necessary to change or remove the nut, the key F, may be sprung out of the position

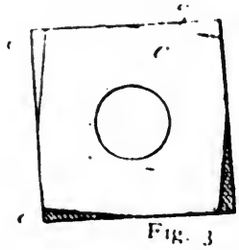


Fig. 3

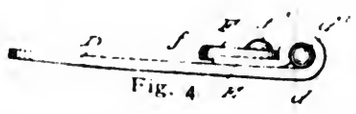


Fig. 4

WHEELER'S NUT-LOCK.

shown, and moved away from the side of the nut, when the latter may be turned on the bolt until its side is parallel with the edge of the plate E, which may then be set in the position indicated by the dotted profile lines in Fig. 2, and the bolt and nut controlled as desired.

It is specially claimed for this form of nut-lock that it is thoroughly simple, economical and efficacious, giving much better results than the forms hitherto in use. A particularly valuable feature of the device lies in the fact that no unauthorized person is able to unlock the bolt or remove the nut without the aid of the necessary wrench.

The invention is under the entire control of the inventor, to whom all communications and inquiries should be addressed.

Cheney's Injector.

WALTER L. CHENEY, of Chicago, Ill., is the inventor of a new and improved form of injector, which is herewith illustrated and described.

This invention relates to that class of injectors used for the purpose of first lifting and then forcing water by the direct application of steam under pressure.

The object of the invention is to furnish an apparatus which shall be at once effective, convenient to use and to manufacture, and in which the valves shall be of simple construction, and so arranged as to require a minimum of repairing.

In the illustration the apparatus is arranged horizontally, but this position is not essential.

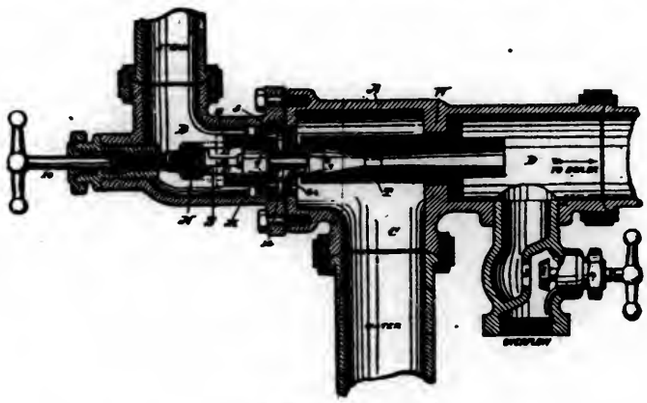
A designates the injector casing or body; B, the steam-chamber, to which steam under suitable pressure is supplied by a pipe in the usual manner.

The injector-casing is divided into two parts by a partition-wall W. The right-hand part or discharge-chamber D, has a connection with the boiler or other place to be supplied by the injector and an overflow-valve of the ordinary description. This will be fully understood from the drawing, in which the overflow-valve disk is designated by 2, and the corresponding valve-seat by 3. The left-hand or receiving chamber C, is provided with the usual water-supply pipe, and is formed to have bolted or

otherwise secured thereto, the aforesaid steam-chamber B. These two chambers are divided from each other by plates 4 and 5, between which plates there is formed the chamber 6, having any suitable passage, as 7, communicating with chamber B. Plate 5, is provided with a nozzle 8, for a jet to lift the water into chamber C, and plate 4, with a nozzle 9, for another jet to force it from said chamber into the combining-tube T, which is supported in wall W, and delivers into chamber D. In practice the relative sizes and proportions of this tube and of the nozzles should be calculated for and adapted to the conditions under which the injector is to be used.

Plate 5, on the side opposite to nozzle 8, serves as an annular valve-seat inclosing passage 7. An annular valve M, sliding in chamber B, is fitted on to said seat so as to close the communication between chamber 6, and chamber B.

Steam is admitted to or excluded from the interior of valve M, by means of a valve N, which is shown in its open position, but which may be closed, as indicated by dotted lines, by means of the ordinary threaded valve-stem 10, shown at the extreme left hand of the drawing. It will of course be understood that it is not essential what means are employed for operating said valve N.



CHENEY'S INJECTOR.

This valve is fitted to seat 11, and is provided with an externally-flanged or hooked stud S, which engages with an internal flange of valve M. By this means, after valve N, has been raised from its seat, as shown, the further raising of it lifts the said valve M, from its annular seat on plate 5, admitting steam from within valve M, through passage 7, and chamber 6, into nozzle 9, to form the forcing-jet. The hooked stud S, is not round, but in section is cross-shaped, the space between its wings 12, (usually three or four in number) forming passages into the interior of valve M. It is preferable also to notch the outside of the larger part of valve M, so as to more freely admit steam, when this valve is lifted, to passage 7.

The operation of this device is substantially the same as the operation of other two-jet injectors. When the apparatus is not in use, valve M, is closed on to its seat, on plate 5, and valve N, on to its seat 11, on valve M.

To put the apparatus into operation, suitable steam and water connections having been made and the overflow being open, valve N, is opened, admitting steam through valve M, into nozzle 8, to form the lifting-jet. Then valve N, is further lifted, and this lifts valve M, from its seat; admitting steam through passage 7, and chamber 6, into nozzle 9, to form the forcing-jet. This jet being established, the overflow-valve is closed and the water driven into the boiler. The annular valve M, is preferably a freely-revolving one, because then it will in practice turn within chamber B, every time it is opened, naturally keeping the valve-faces and valve-seats true and steam-tight. This will be recognized as an important advantage by practical engineers.

By making plates 4 and 5, of circular form they are more readily manufactured. They are readily held in proper relation to each other, by letting one within a rim 14, formed on the other. By a similar method of construction they are also held in proper relation to the other parts of the injector, as clearly shown in the drawing.

It is claimed for this form of injector that it is simple, reliable and economical, and is perfectly adapted and easily applicable to all boilers as a simple and efficacious feeder.

It is under the sole control of the inventor, to whom all inquiries and communications should be addressed, at No. 128 Dearborn Ave., Chicago, Illinois.

Brinkerhoff's Car-Coupling.

PARCEL BRINKERHOFF, of Battle Creek, Mich., is the inventor of a new and improved form of car-coupling, which is herewith illustrated and described.

This device is designed as an improvement on a former patent bearing date October 27, 1885, No. 329,266, in which two hooked coupling-bars are employed, pivoted at one end to the draw-heads and adapted to engage with each other when the opposing draw-heads come together; and the invention consists in the details of construction substantially as shown in the drawings, as hereinafter described.

In the accompanying cuts, Fig. 1 is a horizontal section through the draw-heads, showing the operating

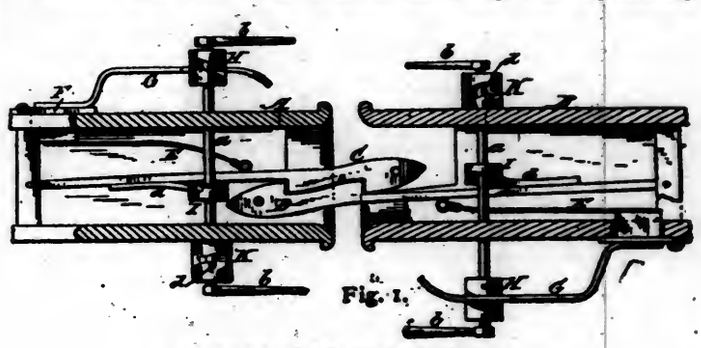


Fig. 1.

BRINKERHOFF'S CAR-COUPLING.

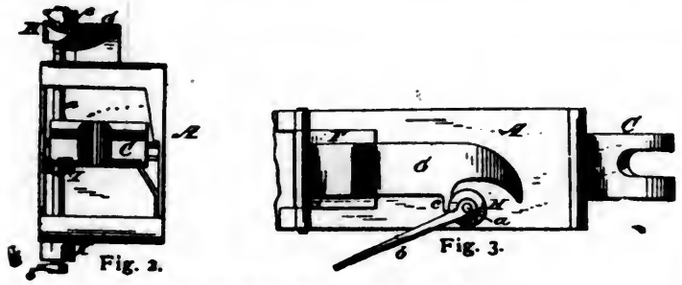
mechanism of the coupler; Fig. 2, an end view of one of the draw-heads; Fig. 3, a side elevation thereof, and Fig. 4 a detail view of one of the coupling-bars.

A B represent the opposing draw-heads of a railroad-car, having pivoted therein the notched coupling-bars C D. The notched ends of the coupling-bars are retained in engagement with each other by a suitable spring E, the free ends thereof bearing against the back of the bars, the opposite end of the spring being connected to a hinged door F, said door being hinged at the inner side or end of the draw-head or at any other preferred place. Rods *a*, have their bearings in the sides of the draw-heads, and are operated by suitable levers *b*, on the extremities of the rods, whereby they can be operated from either side

of the car. Any suitable means, however, may be employed for operating the rods. as found most desirable.

To the door F, is secured one end of a plate G, extending out some distance from the side of the draw-head and having an upwardly projecting arm *c*, which engages with a grooved cam H, on the outer end of the rod *a*. Thus, by turning the rod in the proper direction, the door F, will be pressed in to bring the spring with increased tension against the side of the draw-head.

Connected to the rod *a*, within the draw-head, is a cam I, and bearing against the face of the cam is an arm *d*, rigidly connected to the side of the coupling-bar, which, by the turning of the rod will bring the notched end of one coupling-bar against that of the other, relieving the spring.



BRINKERHOFF'S CAR-COUPLING.

The action of the two cams above described are simultaneous in their action on the spring and draw-head, the object thereof being to reduce the power of the spring more than is given to it by the movement to the hooks; hence the bearing-face of the cam H, may be steeper, to give a longer movement inward and outward to the plate G, than the face of the cam I, that gives movement to the notched coupling-bar.

A grooved cam K, is connected to one side of the draw-head, through which loosely passes the end of the rod *a*, which has a pin or pins *d*, for engaging with the inclined faces of the cam, thereby providing additional means for laterally moving the rod at the same time it is being turned.

BRINKERHOFF'S CAR-COUPLING.

The nearer the rods *a*, are placed to the inner ends of the coupling-bars C D, the less movement of the levers *b*, is required to act upon the bars and take the power off the springs, and the increased inclination of the face of the cam H, over that of the cam I, enables a greater extent of movement at the hinge-connection of the door than there is to the coupling-bars.

If preferred, the plate G, and cam H, may be located inside the draw-head, at the side thereof, in place of on the outside, as shown, these changes coming within ordinary mechanical skill and not affecting the principle of the invention.

It is not neccesary to confine this device to any special form of hooked coupling-bars; and, if preferred, a single hook may be used in place of the double hooks shown, and a spiral or any other suitable spring may be used in place of the spring E; and many other minor changes may be made in the coupling that would come within the scope of ordinary mechanical skill.

It is specially claimed for this form of car-coupling that it admits of coupling cars of varying height with equal facility, and that the clutches operating in connection with the spring permit the pressure to be taken off coupling-bars when the same are being opened to release cars; while the middle clutch having a bearing on but one face, allows the spring to give while rounding curves, and also renders simple and easy the automatic coupling of the cars.

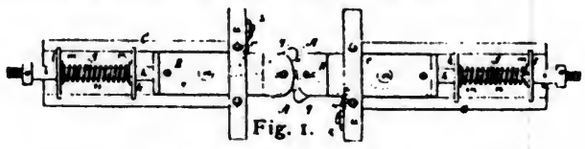
All inquiries and communications should be addressed to Parcel Brinkerhoff, Battle Creek, Michigan.

Tillson's Car-Coupling.

ISAIAH TILLSON, of South Abington, Mass., is the inventor of a new and improved form of car-coupling, which is herewith illustrated and described.

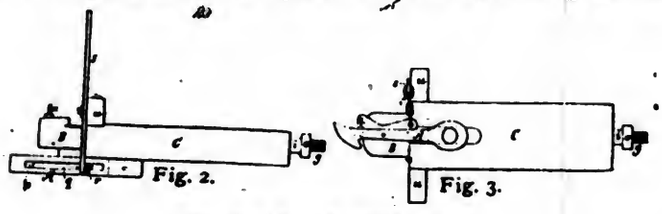
This coupling is of the class in which there is a hook to engage with that of another such coupling, in order to connect or couple two cars together.

In the accompanying cuts, Fig. 1 is a top view of two of the improved car-couplings in engagement with each other. Fig. 2 is a side elevation; Fig. 3, an under-side view; Fig. 4, a horizontal section; and Fig. 5, a longitudinal and median section, of one of such couplings.



TILLSON'S CAR-COUPLING.

In the cuts the said hook is shown at A, as arranged below and pivoted to a draw-bar B, adapted to slide lengthwise in a trough C. The pivot *a*, of the hook projects up through a chamber *b*, in the draw-bar, provided with a movable cap *c*. Through the said pivot and in the said chamber is a bar *d*, that extends between the free ends of two springs *e e*, arranged as represented and secured within the chamber. From the draw-bar a rod *g*, projects rearwardly through two flanged tubes or thimbles *k i*, which are arranged as represented, and to slide lengthwise in two partitions *k l*, extending across



TILLSON'S CAR-COUPLING.

the trough, there being between the heads or flanges *m*, and encircling the rod *g*, a spiral spring *n*. The rod at its rear end is screw-threaded, and has a nut *o*, screwed upon it and against the end of the rearmost thimble. The hook A, is slotted horizontally and lengthwise of it, as shown at *p*, and has within the slot a bent lever *q*, which, at or near its middle is fulcrumed to the hook. A chain *r*, connects the tail of the lever with the lower arm of another lever *s*, the latter lever being fulcrumed to a bar *u*, extending across and fastened to the trough.

Furthermore, there is within the draw-bar head a mouth *v*, to receive a link *w*, for connecting the draw-bar to another, as occasion may require, a pin *x*, for engaging the link going down through the said mouth.

When two cars provided with couplings, as set forth, are brought together to be coupled, the two hooks of

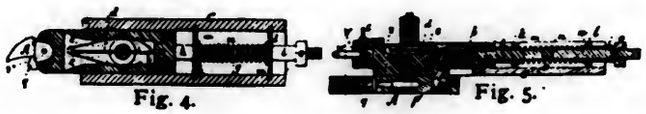


Fig. 4. Fig. 5.

TILLSON'S CAR-COUPLING.

the couplings will each press the other aside until their heads may pass one another, which taking place, each will be forced toward the other and will hook upon or couple with it. To disengage them it is only necessary to so move one of the levers in each hook as to cause such lever to crowd the two hooks out of engagement with each other. On the draw-bar being pulled forward within the trough, the front thimble will serve as an abutment to support the spiral spring, which will be contracted lengthwise by the rear thimble being drawn against it. So, on the draw-bar being moved rearward in the trough the rear thimble will in like manner serve as an abutment to the spring, and such spring will be contracted lengthwise by the front thimble being forced against it.

It is claimed for this form of coupling that it is thoroughly simple, safe, and effective, and especially adapted to freight cars. It is further claimed that in the latter use it is absolutely safe as regards human life, as its construction and operation entirely obviate the slightest risk of life or limb.

The device is under the sole control of the inventor, to whom all communications should be addressed.

GENERAL OFFICES **THE ROTE AUTOMATIC BRAKE COMPANY,**

MANSFIELD, OHIO, *November 3d, 1884.*

To the Westinghouse Air Brake Company, Pittsburgh, Pa.:

GENTLEMEN:—Understanding from your published announcements that you recommend your brake for freight-train use we respectfully invite you to a complete and searching public test of its merits in competition with the *Rote Automatic Brake* This test to be made in so complete and critical a manner as to show all the railroads of the country, as well as the Railroad Commissioners of the various States, which of the two brakes is the one which should be used; for the test will, we are certain, leave no doubt in the minds of any witnessing it.

To insure the proper management of the test we suggest that you choose one person, we another, and these two a third person, all three to be well known as capable and honorable rolling-stock experts, to conduct the test, their expenses to be jointly borne by you and by us.

An invitation to witness the test to be extended to the General Officers of Railroads and all State Railroad Commissioners to the members of the National Car-Builders Association, and to the Railroad and daily press.

The test to be at such time and place as may be mutually agreed upon, but we suggest that the proper place would be on some road having high grades and sharp curves, so that both brakes may have as hard and complete a test as possible. As it is necessary to make the test searching and complete, and as all railroads wish to increase the length of their trains and only wait for a brake which will enable them to do so, we think each train should be made up of 50, 60 or 70 cars, as you may prefer, or, if you think best, of even more cars.

Your company to supply your train and engines, we to supply ours.

The following points, among others, to be considered and reported upon:

Cost of equipping trains.

Simplicity.

Freedom from breakage.

Certainty of action.

Effectiveness.

Cost of maintaining.

"Flatting" of wheels.

Any other points submitted by you or by us in writing to be added to the above.

The brakes or trains are to be tested in every manner and under all conditions which practical railway service may suggest, including yard as well as line service.

Among others the following tests are to be applied to both trains:

1st.—Each train is to be (part of the time) run by engineers and crews who have never operated either brake and who are wholly unfamiliar with them.

2d.—The trains are (part of the time) to be partly made up (as nearly all freights are everywhere) of foreign cars, which have neither your nor our brake on, so that the cars having your break or ours on shall be widely and irregularly separated from each other.

3d.—The locomotives drawing your train and ours to be exchanged, from time to time, and draw each others trains.

4th.—Two locomotives equipped as so many freight engines and tenders are, with hand-brakes instead of steam or air brakes, are to be substituted for the two engines used in the test part of the time. Any brake which will not work properly if this is done, you will admit, can be of little practical value in actual service.

5th.—From time to time each train is to be stopped and foreign cars (not equipped with either your brake or ours) are to be run into it, at irregu ar intervals, just as actual service requires constantly.

6th.—In the making up of trains, etc., crews are to be exchanged at random, so that the test may fully illustrate the convenience of operating each kind of brake in actual ordinary service.

7th.—Frequent short runs, stops and quick starts are to be made.

8th.—A series of yard tests are to be made, showing the action, convenience, etc., of the two brakes.

We mention a few necessary tests only, and you and we, as well as the test committee, are to add any number of others, it being distinctly understood that if you decline any test proposed by us, or we decline any proposed by you, it shall be condered an explicit and positive admission of inferiority.

This rule must in every case be strictly observed, namely: *Both brakes must be tested in precisely the same manner*, so that there may not only be absolute fairness, but no room for suspicion even of anything else.

You have been in the brake field a long time, have profited justly and largely from the patronage of railroads, and we are sure will welcome this plan for allowing your patrons and the American public to judge for themselves which brake should come into universal use.

Having proper confidence in the merits of your brake we know you will gladly and promptly accept our proposition herein made, as you must feel that the test will be complete.

The railroad public is a very fair-minded, capable body, and will most thoroughly appreciate and fully recognize the equity and fairness of our offer to you, and, in common with business-like people everywhere, will naturally (and, we are sure you will admit, properly) consider it a virtual confession of inferiority and a public admission that the Westinghouse Brake is inferior to the Rote Brake and that it is unfitted for general freight service, should you decline or neglect to avail yourselves of the proposition we make you herein.

Permit us to add in closing that we wish to express to you our desire to have this communication received in the spirit in which it is sent, and to have it express to you our wish for a full, fair and searching test of the two articles in the relative merits of which the railroad interest is *primary* and that of the owners even secondary. Respectfully,

THE ROTE AUTOMATIC BRAKE COMPANY,

Per M. D. HARTER, President.

American Railroad Journal.

WHOLE NO. 2,580.] NEW YORK, SEPTEMBER, 1886. [VOLUME LX.—No. 6.

FLAME CONTACT—A NEW DEPARTURE IN WATER HEATING.*

IT is my intention to prove to you on theoretical grounds, and also by experimental demonstration in such a manner as will admit of no possible doubt, that the present accepted system of water heating, by gaseous or other fuel, is a very imperfect means for an end, and is, both in theory and practice, essentially faulty. My statements may appear bold, but I come prepared to prove them in a manner which I think none of you will question, as the matter admits of the simplest demonstration. I will, in the first place, boil a specified quantity of water in a flat-bottomed vessel of copper; the time required to boil this you will be able to take for yourselves, as the result will be visible by the discharge of a strong jet of steam from the boiler. I will then take another copper boiler of the same form, but with only one-half the surface to give up its heat to the water, and will in this vessel boil the same quantity of water with the same burner in a little over one-half the time, thus about doubling the efficiency of the burner, and increasing the effective duty of the heating surface fourfold, by getting almost double the work from one-half the surface.

The subject is a comparatively new one, and my experiments are far from complete on all points, but they are sufficiently so to prove my case fully. As, no doubt, you are all aware, it is not possible to obtain flame contact with any cold, or comparatively cold, surface. This is readily proved by placing a vessel of water with a perfectly flat bottom over an atmospheric gas-burner; if the eye is placed on a level with the bottom of the vessel, a clear space will be seen between it and the flame. I cannot show this space on a lecture table to an audience, but I can prove its existence by pasting a paper label on the bottom of one of the boilers, and exposing this to the direct impact of a powerful burner during the time the water is being boiled, and you will see that it comes out perfectly clean and uncolored. Now, it is well known that paper becomes charred at a temperature of about 400° F., and the fact that my test-paper is not charred proves that it has not been exposed to this temperature, the flame being, in fact, extinguished by the cooling power of the water in the vessel. I need hardly remind you that the speed with which convected or conducted heat is absorbed by any body is in direct ratio to the difference between its own temperature and that of the source of heat in absolute contact with it; and, therefore, as the source of the heat taken up by the vessel is nothing but unburnt gases, at a temperature below 400° F., the rate of absorption cannot, under any circumstances, be great, and the usual practice is to compensate for this inefficiency by an enormous extension of surface in contact with the water, which extension I will prove to you is quite unnecessary. You will see I have here a copper vessel with a number of solid copper rods depending from the lower surface; each rod passes through into the water space and is flattened into a broad head, which gives up its heat rapidly to the water. My theory can be stated in a few words: The lower ends of the rods, not being in close communication with the water, can, and do attain, a temperature sufficiently high to admit of direct flame contact, and as their efficiency, like that of the water surface, depends on the difference between their own temperature and that of the source of heat in absolute contact with them, we must, if my theory is correct, obtain a far greater duty from them. I do not wish you to take anything for granted, and although the surface of the rods, being vertical, can only be calculated for evaporating power at one-half that of a horizontal surface, as is usual in boiler practice, my margin of increased duty is so great that I can afford to ignore this, and to take the whole at what its value would be as horizontal surface, and still obtain a duty 50 per cent. greater from a surface which is the same in area as the flat-bottomed vessel on the fire side, but having only one-third the surface area in contact with the water. I do not, of course, profess to obtain more heat from the fuel than it contains, but simply to utilize that heat to the fullest possible extent by the use of heating surfaces, beyond comparison smaller than what have been considered necessary, and to prove not only that the heating surfaces can be concentrated in a very small area, but also that its efficiency can be greatly increased by preventing close water contact, and so permitting combustion in complete contact with a part of the heating surface. I will now boil 40 ounces of water in this flat-bottomed copper vessel, and, as you will see, sharp boiling begins in 3 minutes 15 seconds from the time the gas is lighted. The small quantity of steam evolved before this time is of no importance, being caused partly by the air driven off from the water and partly from local boiling at the edges of the vessel owing to imperfect circulation. On the bottom of this vessel is pasted a paper label which you will see is untouched by the flame, owing to the fact that no flame can exist in contact with a cold surface.

It may be thought that, owing to the rapid conducting power of copper, the paper cannot get hot enough to char. This is quite a mistake, as I will show you by a very curious experiment. I will hold a small plate of copper in the flame for a few seconds, and will then hold it against the paper. You will see that, although the copper must of necessity be at a temperature not exceeding that of the flame, it readily chars the paper. We can, by a modification of this experiment, measure the depth of the flameless space, as the copper, if placed against the paper before it has time to be previously heated, will, if

* A Paper read by Thomas Fletcher, F.C.S., at the Gas Institute Meeting, London, June 9th.

not thicker than $\frac{1}{40}$ inch, never become hot enough to discolor the paper, showing that the flame and source of heat must be below the level of a plate of metal this thickness.

In repeating this experiment I must caution you to use flour paste, not gum, which is liable to swell and force the paper past the limit of the flameless space, and also to allow the paste to dry before applying the flame, as the steam formed by the wet paste is liable also to lift the paper away and force it into the flame. I will now take this vessel, which has only one-half the surface in contact with the water, the lower half being covered with copper rods, $\frac{3}{16}$ inch diameter, ½ inch centers apart, and 1½ inch long, and you will see that, with the same burner as before, under precisely the same conditions, sharp boiling takes place in 1 minute 50 seconds, being only 13 seconds more than half the time required to produce the same result with the same quantity of water as in the previous experiment. Although the water surface in contact with the source of heat is only one-half that of the first vessel, and the burner is the same, we can see the difference not only in the time required to boil the 40 ounces of water, but also in the much greater force and volume of steam evolved when boiling does occur. With reference to the form and proportions of the conducting rods, these can only be obtained by direct experiment in each case for each distinct purpose. The conducting power of a metallic rod is limited, and the higher the temperature of the source of heat, the shorter will the rods need to be, so as to insure the free ends being below a red heat, and so prevent oxidation and wasting. There are also other reasons which limit the proportions of the rods, such as liability to choke with dirt and difficulty of cleaning, and also risk of mechanical injury in such cases as ordinary kettles or pans; all these requirements need to be met by different forms and strengths of rods to insure permanent service, and, as you will see further on, by substituting in some cases a different form and type of heat conductor. To prove my theory as to the greater efficiency of the surface of the rods in contact with the flame, as against that in direct contact with the water, I have another smaller vessel which, including the rods, has the same total surface in contact with the flame, but only one-third the water surface as compared with the first experiment. Using again the same quantity of water and the same burner we get sharp boiling in 2 minutes 10 seconds, being an increase of duty of 50 per cent., with the same surface exposed to the flame. The rods in the last experiment form two-thirds of the total heating surface, and if we take, as I think for some careful experiments we may safely do, one-half the length of the rods to be at a temperature which will admit of direct flame contact, we have here the extraordinary result that flame contact with one-third of the heating surface increases the total fuel duty on a limited area 50 per cent. This really means that the area in contact with flame is something like six times as efficient as the other. In laboratory experiments it is necessary not only to get your result, but to prove your result is correct, and the proof of the theory admits of ready demonstration in your own laboratories, although it is unfit for a lecture experiment, at all events in the only form I have tested it. If you will take two ordinary metal ladles for melting lead, cover the lower part of one of these with the projecting rods or studs and leave the other plain, you will find on melting a specified quantity of metal in each that the difference in duty between the two is very small. The slight increase may be fully accounted for by the difference in the available heating surface reducing the amount of waste heat passing away, and this proves that flame contact, and, therefore, quick absorption of heat, takes place on plain surfaces as soon as these are above a certain temperature, which, in a metal ladle, very soon occurs. What the temperature is which admits of flame contact I have, as yet, not been able to test thoroughly, and it will need some consideration how the determination of this is to be correctly made; at the same time it is a question in physics which should be capable of being answered.

Let us now take the other side of the question. If the efficiency of a surface depends on flame contact, there must, of course, be flame, or at least gases of an extremely high temperature, and we, therefore, cannot expect this extraordinary increase of efficiency in any part of our boiler except where flame exists, and if these projectors are placed in a boiler, anywhere except in contact with flame, their efficiency must be reduced to that of ordinary heating surface. They are, of course, useful, but only in the same way as ordinary flue surface. When we come to boilers for raising steam, which have to stand high pressures, we come to other difficulties of a very serious nature, which require special provision to overcome them. To put such rods as I have referred to in a boiler-plate necessitates the plate being drilled all over with holes, causing a dangerous source of weakness, as the rods cannot be used as stays; further than this, they would render really efficient examination a matter of extreme difficulty, and would be liable to give rise to frequent and almost incurable leakages; but there is, fortunately, a very simple way to overcome this difficulty. I have found that rods or points, such as I have described, are not necessary, and that the same results can be obtained by webs or angle-ribs rolled in the plates. My experiments in this direction are not complete, and at present they tend to the conclusion that circular webs, which would be of the greatest efficiency in strengthening the flues, are not so efficient for heating as webs running lengthwise with the flue, and in a line with the direction of the flame. This point is one which I am at present engaged in testing with experimental boilers of the Cornish and Lancashire types, and as, with gas, we have a fuel which renders every assistance to the experimenter, it will not take long to prove the comparative results obtained by the two different forms of web. Those of you who have steam boilers will, no doubt, know the great liability to cracking at the rivet-holes in those parts where the plates are double. This cracking, so far as my own limited experience goes, being usually, if not always, on the fire side, where the end of the plate is not in direct contact with the water—where it is, in fact, under the conditions of one of the proposed webs—I think we may safely come to the conclusion that this cracking is caused by the great comparative expansion and contraction of the edge of the plate in contact with the fire; and it will probably be found that if the plates are covered with webs the whole of the surface of the plates will be kept at a higher and more uniform temperature, and the tendency to cracks at

the rivet-holes will be reduced. This is a question not entirely of theory, but needs to be tested in actual practice.

There is another point of importance in boilers of the locomotive class, and those in which a very high temperature is kept in the fire-box, and this is the necessity of determining by direct experiment the speed with which heat can safely be conducted to the water without causing the evolution of steam to be so rapid as to prevent the water remaining in contact with the plates, and also whether the steam will or will not carry mechanically with it so much water as to make it objectionably wet, and cause priming and loss of work by water being carried into the cylinders. I have observed in the open boilers I use that when sufficient heat is applied to evaporate 1 cubic foot of water per hour from 1 square foot of boiler surface, the bulk of the water in the vessel is about doubled, and that the water holds permanently in suspension a bulk of steam equal to itself. I have, as yet, not had sufficient experience to say anything positively as to the formation or adhesion of scale on such surfaces as I refer to, but the whole of my experimental boilers have up to the present remained bright and clean on the water surface, being distinctly cleaner than the boiler used with ordinary flat surfaces. It is, I believe, generally acknowledged that quick heating and rapid circulation prevents to some extent the formation of hard scale. and this is in perfect accord with the results of my experiments. The experiments which I have shown you I think demonstrate beyond all question that the steaming power of boilers in limited spaces, such as our sea-going ships, can be greatly increased; and when we consider how valuable space is on board ship, the matter is one worthy of serious study and experiment. It may be well to mention that some applications of this theory are already patented.

I will now show you as a matter of interest in the application of coal gas as a fuel how quickly a small quantity of water can be boiled by a kettle constructed on the principle I have described, and to make the experiment a practical one I will use a heavy and strongly-made copper kettle which weighs 6½ pounds, and will hold when full one gallon. In this kettle I will boil a pint of water, and, as you see, rapid boiling takes place in 50 seconds. The same result could be attained in a light and specially made kettle in 30 seconds, but the experiment would not be a fair practical one, as the vessel used would not be fit for hard daily service, and I have, therefore, limited myself to what can be done in actual daily work rather than laboratory results, which, however interesting they may be, would not be a fair example of the apparatus in actual use at present.

THE GRAPHOPHONE.

ONE of the most brilliant conceptions of Mr. Thomas A. Edison was, that a record could be made of sounds from which the sounds could be reproduced. After considerable experiment, Mr. Edison invented the instrument known the world over as the phonograph. This little machine consists of a cylinder about three inches in diameter, covered with a shallow spiral groove, upon which is placed tinfoil. The cylinder is so arranged that it will travel horizontally back or forth by means of a screw, and is operated by a crank. The sounds are communicated to the tinfoil by a steel point attached to a diaphragm that is agitated by the sounds coming through a tube, to which is attached a mouth-piece. The concussion of the sound-waves striking upon the diaphragm forces the metal point forward, which is already in contact with the tinfoil, and makes indentations as the cylinder revolves with the movement of the crank.

In order to reproduce the sounds the diaphragm is replaced to its point of starting, and the steel point goes over the record, following the path of the indentations made on the tinfoil upon the rotation of the cylinder. The point agitates the diaphragm, which in turn agitates the air in the tube, and the repetition of the sound is thereby produced.

Several hundred of the machines above described were put upon the market, and quite a number were sold, but the phonograph failed to make a success, for the reason that the machine was not only a clumsy piece of mechanism, frequently getting out of adjustment, but more especially because of the fact that the surface upon which the record was made was pliable, and likely to be obliterated by a mere accidental pressure upon it.

Believing in the possibility of making a successful machine to record and reproduce sounds, Prof. Alexander Graham Bell, Dr. Chichester A. Bell, and Mr. Sumner Tainter associated themselves together, under the name of the Volta Laboratory Association, and established a laboratory in the city of Washington, one of the principal objects of which was to experiment upon methods of recording and reproducing sound. After several years of experiment the inventors of the graphophone now desire that the writer shall introduce to the world the results they have obtained.

The word "graphophone" is a simple transposition of the word "phonograph," and is intended to convey the same meaning.

Mr. Sumner Tainter soon saw that tinfoil presented a surface unfit for the purpose it was called upon to fulfill, because of its pliability and destructibility. Many and elaborate experiments were made to discover a substance upon which a perfect and durable sound-record could be made. Mr. Tainter conceived the idea of using a surface upon which the sound-record could be cut, instead of indenting a soft and pliable surface as is done in the Edison machine. It was finally decided upon to use a paper surface coated with a preparation composed of wax and paraffine.

The graphophone is made in two forms, one to make the records upon a cylindrical surface, the other upon a disk or flat surface, the same principles, however, governing each machine. The machines are provided with two diaphragms; one used in making the record and the other in reproducing the sound. The cylindrical machine stands about five or six inches high by eight wide, and weighs about ten pounds. There is no skill required in the manipulation of the machine, the rotation of the cylinder being accomplished by a crank or automatic motion. Mr. Tainter has exhibited a great amount of ingenuity and skill in devising the various parts of the machine, and suiting them to the purposes for which they were designed. The instrument is a marvel of perfection in accuracy of the movements of all its parts.

Upon a diaphragm three inches in diameter a steel point is attached, which cuts a minute hair-line in the surface of the waxed cylinder upon the agitation of the diaphragm by a sound. The indentation is so slight as to be scarcely perceptible, and yet these records can be gone over time and again, and are just as perfect after a hundred repetitions as they were at first.

Upon a cylinder six inches in length by an inch and a quarter in diameter, one is enabled to record at least five minutes' conversation. The cylinder-holder is constructed with a ball joint at one end, and can be easily tipped so as to allow the hollow cylinder to be rapidly slipped on or off.

The disk machine possibly has some advantages over the cylindrical machine, because of the fact that the record is made upon a flat surface, and appears in the form of a spiral line. For the purpose of copying records, and possibly for preservation, the flat surface is probably superior, but as each machine has advantages peculiar to itself, it is a difficult matter to judge which will prove the superior for all purposes.

Either of these machines is in a condition at the present time to do the amanuensis work usually done by stenographers. For instance, any one may sit before the graphophone and in ordinary tones speak his daily correspondence into the machine. His letters can then be written by a copyist, who can write from the dictation of the machine.

By a neat mechanical contrivance the operator is enabled to take as many words at a time as he can conveniently remember, and should he forget any part of the the sentence, by a slight pressure of the finger on a rod running along the base of the machine the reproducer will repeat the sentence.

Should a correspondent also have a graphophone, the writer of the letter could in a few moments dictate what would make a lengthy epistle, enclose it in a box about the size of the apothecary's "pill box," place a stamp thereon, and transmit through the mails. The correspondent can in turn place the cylinder received upon his graphophone, and listen to the letter of his friend with his voice preserved, thereby avoiding the vexation and loss of time consequent upon an encounter with bad chirography.

One of the most novel and interesting features of this machine is its ability to record the sounds of a number of voices speaking at the same time; this is done on one instrument, by one diaphragm, one metallic point, and upon a single line. How it is done finds an explanation in the fact that the different tones of the voices vibrate with unlike speed and force, and thus make different impressions upon the diaphragm, and move the metallic point in a different way, so as to make a record of the various sounds. The diaphragm of this machine, like the drum of the ear, can receive and record distinctly the various sounds of a quartet of singers.

The graphophone is now prepared to represent all moods; it will tell you a funny story, and laugh with you in natural tones; it will repeat a tragedy that is blood-curdling in its nature; it will tell you a love story with all the ardor of a wooer; it will sing you an Irish song, or whistle a selection from the "Mikado."

It is expected soon to be able to correctly reproduce the songs of great singers, and the recitations, dialogues, etc., of distinguished actors, and, by a process already successful, to copy the records of the songs or recitations and dispose of them at a trifle, thus enabling a person to enjoy at home such delightful singing as Patti would render, or such elocution as we would listen to from Edwin Booth.—F. Z. MAGUIRE, in *Harper's Weekly*.

The Master Mechanics' Association.

COMMITTEES AND SUBJECTS FOR DISCUSSION AT THE TWENTIETH ANNUAL MEETING, JUNE, 1887.

No. 1. *Proportion of Locomotive Cylinders.* To give the best results, what rule should be followed for proportioning the cylinders of an engine, when the size of driving-wheels, weight available for adhesion and boiler steam pressure are given quantities? Charles Blackwell, Union Pacific; F. L. Wanklyn, Grand Trunk; T. E. Barnett, Canadian Pacific.

No. 2. *Traction Increasers.* Their various types and relative merits; also, cases in which their use can be recommended. R. H. Briggs, Chesapeake, Ohio & Southwestern; D. O. Shaver, Pennsylvania; T. J. Hatswell, Flint & Pere Marquette.

No. 3. *Cross-heads and Guide-Bars.* The various types in use, the materials and their construction, and results obtained. F. M. Dean, N. W. Harrison, J. B. Henny, New York & New England.

No. 4. *Packing.* The various forms of piston packing in use, and obtained results. Also, the most economical and satisfactory packing for piston-rods, valve-stems, regulator and air-pump stuffing boxes, with results obtained. J. W. Stokes, Ohio & Mississippi; Allen Cooke, Chicago & Eastern Illinois; Henry Schlacks, Illinois Central.

No. 5. *Locomotive Preparation.* Washing and lighting up locomotives; showing the best system in use for washing out and the most economical and expeditious mode of raising steam and the necessary plant for same. G. W. Ettenger, Chesapeake & Ohio; W. H. Thomas, East Tennessee, Virginia & Georgia; T. W. Gentry, Richmond & Danville.

No. 6. *Coaling up Locomotives.* The various plans in use and their relative cost and efficiency. J. Davis Barnett, Canadian Pacific; James Strode, Northern Central; Charles Graham, Delaware, Lackawanna & Western.

No. 7. *Standard Form of Tire Section.* J. N. Lauder, Old Colony; Jacob Johann, Chicago & Atlantic; H. N. Sprague, Pittsburgh, Pa.

No. 8. *What Control has the Engineer Over the Wear of Driving-Wheel Tire?* John McKenzie, New York, Chicago & St. Louis; J. S. Graham, Lake Shore & Michigan Southern; Fred. B. Griffith, Delaware, Lackawanna & Western.

Associate Member Papers.—F. B. Miles, Robert Grimshaw.

OBITUARY COMMITTEE.

M. M. Pendleton.—C. W. Walker, Seaboard & Roanoke; J. F. Devine, Wilmington & Weldon; James McGlenn, Carolina Central.

G. E. Boyden.—J. N. Lauder, Old Colony; George Richards, Boston & Providence; Jos M. Whitlock, New Haven & Derby.

S. H. Dotterer.—R. C. Blackall, Delaware & Hudson Canal; H. W. Eddy, Boston & Albany; O. Stewart, Fitchburg.

J. C. McCune.—J. S. Turner, Mexican Central; H. P. Olcott, Atchison, Topeka & Santa Fe; A. H. Watts, Texas Pacific.

John Iranson.—James Patterson, Cincinnati, Indianapolis, St. Louis & Chicago; E. A. Campbell, East & West Texas; James Meehan, Cincinnati, New Orleans & Texas Pacific.

GENERAL SUPERVISORY COMMITTEE.

Printing and "Boston Fund."—William Woodcock, Jacob Johann, R. H. Briggs, J. H. Setchel, George Richards.

Standing Committee on Subjects.—T. B. Twombly, Chicago, Rock Island & Pacific; Charles Blackwell, Union Pacific; George Hackney, Atchison, Topeka & Santa Fe.

Committee of Arrangements of Twentieth Annual Meeting.—Geo. W. Cushing, Northern Pacific, St. Paul; Clem. Hackney, Union Pacific, Omaha; R. R. Bushnell, Burlington, Cedar Rapids & Northern, Cedar Rapids.

Inoxidizable Surfaces for Iron.

THERE are many methods, technically known as "bronzing," for rendering the surface of iron inoxidizable, but they are confined to certain trades, such, for instance, as gunmaking, and the engineer knows but little of them. He has neither the time nor the patience to carry out the ten or twenty alternate rustings and polishings which are required to get a good bronzed surface. If he has to expose bright work to the weather, his only resources are constant greasing and rubbing, or the paint brush. In the case where the metal is black, he has a little more scope and can employ either galvanizing or the Bower-Barff process, and cover the object with a protective skin of either zinc or magnetic oxide of iron. A new method, which promises to be easier of application than any of the previous, has, however, been lately brought out by M. A. de Meritens, the well-known electrician, and if it succeeds as well in the hands of the public as it does with the inventor, should find a very extended application. The article to be protected is placed in a bath of ordinary or distilled water, at a temperature of from 70° to 80° Centigrade (158° to 176° Fahr.) and an electric current is sent through. The water is decomposed into its elements, oxygen and hydrogen, and the oxygen is deposited on the metal, while the hydrogen appears at the other pole, which may either be the tank in which the operation is conducted, or a plate of carbon or metal. The current has only sufficient electromotive force to overcome the resistance of the circuit and to decompose the water, for if it be stronger than this, the oxygen combines with the iron to produce a pulverulent oxide which has no adherence. If the conditions are as they should be, it is only a few minutes after the oxygen appears at the metal, before the darkening of the surface shows that the gas has united with the iron to form the magnetic oxide $Fe\ O^4$, which it is well known will resist the action of the air, and protect the metal beneath it. After the action has continued an hour or two, the coating is sufficiently solid to resist the scratch brush, and it will then take a brilliant polish. The depth of penetration is shown by the following fact. A gun barrel was oxidized, and then the magnetic coating was completely removed by emery, until the surface again became white. It was again returned to the bath, and immediately, on the passage of the current, the black color again reappeared. If a piece of thickly rusted iron be placed in the bath, its sesquioxide ($Fe^2\ O^3$) is rapidly transformed into the magnetic oxide. This outer layer has no adhesion, but beneath it there will be found a coating which is actually a part of the metal itself.

In the early experiments with this process, M. de Meritens employed pieces of steel only. But when he turned to objects in wrought and cast-iron he found that he no longer was successful, for the coating was not fast, and came off with the slightest friction. After many trials with currents of different electromotive force, he reversed the order of affairs, and placed the iron at the negative pole of the apparatus, after it had been already applied to the positive pole. Here the oxide was reduced, and hydrogen was accumulated in the pores of the metal. The specimens were then returned to the anode, when it was found that the oxide appeared quite readily and was very solid. But the result was not quite perfect, and it was not until the bath was filled with distilled water, in place of that from the public supply, that a perfectly satisfactory result was attained.

The process, it will be seen, is perfectly simple, and demands but little skill in its execution. Now that dynamo machines have superseded batteries as sources of electricity, all that is required is a tank, a quantity of distilled water, and a little power to drive the machine. By placing a number of baths in series, and increasing or diminishing their number, the electromotive force of the current can be regulated without any arrangements of artificial resistances. We expect that many manufacturers will give this process a trial.—*Engineering.*

Railroad Signals.

A CORRESPONDENT in the *English Mechanic* discusses the subject of signals in the following catechetical form:

Q. What are railroad signals for?

A. To admit a train into a section and to protect it as long as it is in that section by securing an interval of space between it and any following train. Accepting this as their chief function, it goes without saying that good sighting of them is the first essential, and, without wishing to be dogmatical, I claim that this disposes of all argument on the point of which side of the line should they be on. They are for use, and must be where they can best be seen by an approaching driver, and they are not required to be part of a rigid system of propriety, although if, when they are set back a sufficient distance to fulfill their object, they can be as well seen on the left hand or near side of the line as elsewhere, the near side is undoubtedly the right place for them; if not, put them where they can best be sighted. I would not increase the distance simply to get the signal on the near side, having regard to the accompanying disadvantages of increased liability to broken wires, longer lengths of wire for expansion and contraction, more costly to maintain, and a harder pull for the signalman.

Q. What should the colors of the signal-lamps be?

A. All are agreed as to red for danger, "stop," but some

confusion arises from differences of practice as to the color for "go on." It is necessary that the invitation to a driver to go on should be as unmistakable as the signal to stop. White near a town or highway may be a street-lamp, or it may be a danger signal with the red spectacle broken out. A white light, therefore, when seen by a driver where he expects to find his signal, but fails to do so, should be treated as a danger signal, for it may be his own signal at danger and the spectacle broken, or his signal at danger may be blown out; and, as white will not, therefore, do for the "go on" signal, we are left with green as the only alternative. Thus, we have simplicity itself, and the nearest approach to efficiency with it—namely, red, "stop"; green, "go on." These, I submit, are the only two signal lights a driver should have. The terms "caution" and "all right," as separate from each other, are, I consider, likely to lead to confusion—of sense, at any rate. Caution is always necessary in railway working, and to draw a distinction between a "caution" signal and an "all-right" signal (by a *reductio ad absurdum*—go on without caution) is bad in principle. Of course, my remarks are directed to block working, and leave the old time interval system out of account, and my point is that white as an "all-right" signal should be as obsolete as that time-interval system, of which it formed a part, is becoming.

Q. Should green be used as a back-light?

A. Unhesitatingly, no! The object of a back-light is to let the signalman know, first and foremost, that his lamp is burning, and *his signal at danger;* and, secondly, that the signal obeys his lever, and as a back-light should not be of such a color that it can be mistaken for a signal, it should not be green. Blue, purple, or yellow are out of the question, and, therefore, we are left with white as the only alternative, and to get the two indications by this means, we must have the white light for the one, and the absence of it for the other, which demonstrates that the right thing for back-lights is white when the signal is at danger; blank—*i. e.*, no light at all—when it is "off." I am fully aware that many companies adopt green as a back-light, some blue; in fact, there is anything but uniformity of practice on this point, and yet it is of great importance, for there can hardly be a railway man of any long experience who has not known of mishap arising from a green back-light being mistaken by a driver for his signal to "go on." To this day, many new signals when put up are provided with green back-lights, which goes to show that the importance of this part of the subject is not fully recognized. For my part, I would rather be without a back-light at all than have a green one.

Another point upon which the views of correspondents would be valuable is, "Should home signals at stations be so locked as to lead the distant signals, or should the distant signal be free to be lowered whether the home signal is at danger or not, and the reasons for and against?"

Life and Profits of a Car.*

WHEN we consider the cost of equipping a road with cars, the expense to keep them in repairs, and mileage earned, we at once have three very important subjects which involve an enormous amount of capital. An investigation of the subject cannot fail to be interesting, and we will find some important suggestions presented during our examination. Taking the value of a car as the basis, its mileage as revenue or profit, and the repairs as expense, we are sometimes astonished at the vastness of the interests entrusted to our care. A car will cost $500. A road owning a thousand will have invested $500,000; a road operating ten thousand will expend $5,000,000 in equipping itself, etc. During 1882, our management required me to keep an individual mileage record of each car, and, as we were then in the South interchanging daily reports of movements and mileage, I was able to compile my tables from actual figures, and not estimates. A road, as we before mentioned, secures its cars at an immense expense. These cars are then turned loose upon the country and are expected to earn a reasonable interest on the investment. We see at a glance what an important department in railroads this is. The question then is, what is the revenue and expense involved, and what profit to a railroad is a car? This, of course, depends upon the age and condition of a car. Below I present a table showing the average mileage made by our cars of various ages, also repairs done, thus giving the average revenue, expense, and net loss or profit by cars of various ages:

EARNINGS OF BOX-CARS IN GENERAL SERVICE.

Mileage.	Money.	Repairs.	Net Profit.	Per cent. Profit.	Net Loss.	Per ct. Loss.	Age of car Years.
13,149	$98.62	$9.58	$89.04	18			1
13,478	101.08	38.13	62.95	12½			2
10,475	78.56	48.24	30.32	6			3
9,847	73.85	45.85	28.00	6			4
9,881	74.11	57.31	16.80	3			5
9,349	70.12	70.74			$0.62	1-9	6
8,968	67.26	60.74	6.52	1¼			7
9,250	69.37	55.49	13.88	2 4-5			8
9,295	69.71	49.80	19.91	4			9
7,656	57.42	53.67	3.75	¾			10

It will be noticed that, for the first five years cars make good mileage, and will average 9 per cent. profit on the investment; but, during the next five years the mileage decreases, repairs increase, and the net profit is reduced to an average of one and three-fifths per cent. This suggests that for the first five years of a car's life it is a good investment, but after that it is not profitable to run them as an investment. For the first five years a car will net 9 per cent. on the investment, or about half pay for itself in mileage; after that it is almost "nip and tuck" between mileage and repairs for the next five years. The life of a car depends altogether upon how long a road is willing to patch it up with repairs. I believe we have an occasional car now in service which was built twenty years ago, but I apprehend that very little of the original cars remain, and that it has been more expensive to keep them up than it would have been to have destroyed them and used the old iron in the construction of new cars. These figures prove, I think, that mileage at the rate of three-fourths cent per mile is not excessive, and results only in a fair profit on the investment.

* Read by E. C. Spalding, of the Western & Atlantic Railroad, at the Car Accountants' Convention at Buffalo.

Comparative Performance of Simple and Compound Locomotives on Von Borries's System.

Engineering of July 16th, contains a tabular statement which gives the results of comparative trials to determine the saving of fuel with compound locomotives, built on the system of Von Borries, compared with "normal" or simple engines. The results of these trials may be summarized as follows:

1. In the winter of 1882–83, runs with two compound goods and two "normal" goods locomotive engines, and with special trains, made soon after the engines were delivered, and before the persons in charge of them had become well acquainted with the compound system, showed a saving by the compound engines of 10.5 per cent. of fuel.

2. In the summer of 1883, runs with a compound goods engine, six wheels coupled, and a "normal" engine of the same type, with goods traffic, showed a saving of 17 per cent. of fuel.

3. In the autumn of 1883, runs with same compound engine that was used in the second trial, and two "normal" goods engines, with six wheels coupled, made with two special trains, only on mountain stretches, showed a saving of 20 per cent. of fuel.

4. From July 1st, 1883, to April 1st, 1884, a comparison of the performance of two compound engines, like those used in previous trials, and ten "normal" goods engines, with six wheels coupled, showed a saving of 21 per cent. The result of saving in this case was arrived at by an average proportion of the actual consumption of fuel, and the quantity usually allowed for each performance.

5. In the summer of 1884, one of the compound engines used in previous trials and ten "normal" goods engines made runs, with goods trains, showed a saving of 14.3 per cent.

6. In the summer of 1884, one of the compound and one of the simple engines, used in previous trials, made runs with special trains and showed a saving of 16 per cent.

7. Another trial under the same conditions as the previous one described, but made in the autumn of 1884, showed a saving of 16 per cent.

8. From October 1st, 1884, to January, 1885, runs were made with a compound "omnibus" tank engine, uncoupled, and a "normal omnibus" tank engine, also uncoupled, with omnibus trains, and showed a saving of 17 per cent. The saving gained was arrived at as in trial No. 4.

9. From November, 1884, to January, 1885, runs were made with one compound express engine, with four wheels coupled, and a "normal" express engine, with four wheels coupled, and with special trains, a passenger and an express train, and showed a saving of 16 per cent.

10. This trial was made with a compound and a "normal" express engine, with three passenger trains, one courier train and two express trains, and showed a saving of 14.5 per cent.

The first trial lasted three months, the second, third, fifth, sixth, seventh, ninth and tenth lasted two months, and the fourth nine months. The steam pressure varied from 9 to 12 atmospheres.

Boiler Radiation Tests.

PROFESSOR KENNEDY has recently made some careful tests in the Engineering Laboratory of University College, London, of the radiation of heat from a boiler covered and uncovered. The boiler is described as being of the marine locomotive type with a total heating surface of 205 square feet. The working pressure was 120 pounds per square inch. The external radiating surface of the boiler is about 143 square feet,

The results of these trials with the boiler uncovered, showed that, starting with an average pressure of 110 pounds per square inch, it took nearly six hours to reach atmospheric pressure after the fires were withdrawn. The rate of transmission of heat from the surface was about 750 thermal units per square foot per hour at starting, and was diminished to about 400 after six hours, the rate of diminution being fairly constant.

The boiler was then covered all over with a layer, about 1¾ inch thick, of non-conductor (Keenan's composition), and the experiments repeated under like conditions. After eleven hours there was still a pressure in the boiler of 10 pounds per square inch above the atmosphere. The maximum rate of transmission of heat from the surface of the boiler, was 330 thermal units per square foot per hour, as against 750 in the previous experiments, and was 210 after eleven hours.

These experiments show clearly the importance of boiler covering, and also give a means of determining its value and the economy resulting from its use. A full report of the experiments is published in *Engineering* of July 30th

Automatic Couplings in England.

AT a meeting of the Amalgamated Society of Railway Servants recently held in the offices of the Society in London, the general secretary, Mr. E. Harford, in his report submitted to the meeting, first referred to the fact that he had addressed all the railway companies urging upon them the necessity of adopting on their systems one or the other of the wagon couplings approved by the jurors of the coupling trials which took place at Nine Elms, on March 29th and two following days, by the use of which the dangers attendant upon the men having to pass between, or over, or under buffers of wagons for the purpose of coupling or uncoupling them, can be altogether obviated. As some of the companies took no notice whatever of this appeal. Several others wrote that the matter was under consideration. The executive committee passed the following resolution on the coupling question: "That the committee regrets—and considers that the public will regret—that after the trials at Nine Elms proved beyond doubt that efficient mechanical couplings had been invented and were ready to be employed, the railway companies of the country are still neglecting to provide for the safety of the lives of their servants, by adopting one or the other of the appliances of which we so highly approve, as we know by experience that they will greatly reduce, if not entirely prevent, the fearful loss of life which is so terrible; and we are also of opinion that the neglect of the companies should receive the attention of the public, the Board of Trade and Parliament."

The Electrical Transmission of Force.

DURING the last ten years M. Marcel Deprez has been engaged in experiments connected with the transmission of force by means of electricity. The Rothschilds some time since provided him with an unlimited credit to prosecute his researches at Creil, under the inspection of a commission of thirty-eight men of science. On Friday the commission met to hear a report on the results at present obtained, drawn up at their request by M. Maurice

Lévy. This report was unanimously approved. It appears from it that we can now, with only one generator and only one receptor, transport to a distance of about thirty-five miles a force capable of being used for industrial purposes of fifty-two horse power, with a yield of 45 per cent., without exceeding a current of ten ampères. When the amount of force absorbed by the apparatus used to facilitate the recent experiment, but not required in the applications to industrial purposes, is added, the yield will be nearly 50 per cent.

The commission certifies that the machines now work regularly and continuously. The maximum electro-motive force is 6,290 volts. Before the construction of the Marcel Deprez apparatus the maximum force did not exceed 2,000 volts. The report states that this high tension does not give rise to any danger, and that no accident has occurred during the past six months. The commission is of opinion that the transmitting wire may be left uncovered on poles, provided it be placed beyond the reach of the hand. It estimates at nearly £5,000 the probable cost of the transmission of fifty horse power round a circular line of about seventy miles. This price would, however, be much diminished if the machines were frequently constructed.

The commission, in the name of science and industry, warmly congratulated M. Deprez on the admirable results which he had obtained, and expressed thanks to the Rothschilds for the generous aid extended to the undertaking. —*Correspondence London Times, Paris, July 25th.*

Store Orders.

THE Philadelphia *Times* says: "We print in to-day's paper, in *fac-simile*, variously denominated store orders issued for labor by the 'Bellefonte Iron and Nail Company, Limited,' and with them the full text of the act of 1881 forbidding the use of any form of trade orders for labor, and declaring the penalty for the misdemeanor defined by the law. Special importance will be attached to the trade orders for labor issued by the Bellefonte association, because Gen. Beaver, an honored soldier, respected citizen, and the nominated candidate of the dominant party of the State for Governor, is the chief stockholder and president of the company that thus openly violates the law for the protection of wage-laborers. It will be difficult for Gen. Beaver to exonerate himself from the imputation of deliberate lawlessness, and apparently for the purpose of enlarging the profits of his company at the cost of the labor he employs."

[The above shows that workingmen sometimes have just grounds for complaint and dissatisfaction, a fact which some persons, especially some editors of newspapers, try to induce the public to doubt.—EDITOR RAILROAD JOURNAL.]

Slack in Freight Trains.

THE importance which the "slack" of freight trains coupled with the ordinary link and pin was found at the Burlington brake tests to possess, as an element in the production of those severe shocks or bumps experienced in the quick stopping of long trains, led to some very interesting experiments during the last days of the tests. A train of fifty loaded cars was given a continuous close coupling by driving iron wedges into the links, thus taking up all the loose slack and leaving only "spring" slack, or that which is given by the compression of the draw-bar springs when the train is started. It was found necessary to drop one car before the locomotive could start the train on a level. Without the wedges—that is with about 3 inches of loose slack at each coupling—the same locomotive was able to start but 48 cars. The experiments were repeated on the grade, where the highest number of cars which the engine could start either with close or open couplings was 38. For the first time since the question of the part borne by slack in enabling a locomotive to start a long and heavy train began to be discussed by the inventors of link couplers on one side and of hook couplers on the other, the thing has been put to actual test on the track. It seems to be demonstrated that loose slack gives at least no aid in starting a train, but that the slack given by the buffer springs is sufficient. This result is pleasing to those interested in hook couplers.—*Railway Review.*

Tunnel Between Denmark and Sweden.

A TELEGRAM from Copenhagen, published in the *Journal des Débats*, says that the Swedish and Danish newspapers have for some time been discussing schemes for the construction of a tunnel between Denmark and Sweden under the sound. The question of a submarine way between the two countries has been raised several times, but never so seriously as now. In fact, M. A. de Rothe, the engineer, in the name of a French company, has just presented to the two governments interested a plan for cutting a tunnel between Copenhagen and Malmö, in Sweden. The tunnel would be seven and a half miles long, in two parts, of which two miles would lie between the islands of Amak and Sattholm, and five and a half between the latter island and the Swedish coast. M. de Rothe has been for several years employed as an engineer on the Panama Canal works.

The Endurance of Paints.

EXPERIMENTS made under the direction of the administration of the Dutch State railroads with various paints on iron plates are reported to have proved that the red-lead paints resist atmospheric influences much better than those of brown-red and iron oxides. The red-lead paints adhered closer to the metal, and possessed greater elasticity than the others. It was also found that better results were attained if, before the paints were applied, the plates were pickled instead of being merely scraped and brushed. The test plates were pickled in muriatic acid, washed with water, thoroughly dried, and while warm, carefully oiled.

Uniform Rules for Running Trains.

A MEETING was held in Cleveland on July 20th, the object of which was to devise uniform rules for the movement of trains, to be applied to all the railroads of the country. The parties who held the meeting composed a committee of representatives of a number of prominent railroads. Mr. N. F. Allen, editor of the *Official Railway Guide*, acted as secretary of the committee.

NOTES AND NEWS.

RAILS 144 FEET LONG.—The Tredegar Steel Works, in Wales, are now turning out rails 144 feet in length, and these are cut into six lengths of 24 feet each.

RAILROAD WORK IN GERMANY.—The railway wagon and machines works in Germany are all said to be much in want of orders, and none can work full time.

THE SCHENECTADY LOCOMOTIVE WORKS now has at work 950 men. From 16 to 18 engines are turned out every month. The monthly pay roll amounts to nearly $40,000.

STEEL SLEEPERS.—The Midland Railway, of England, are extending the experimental use of steel sleepers on their line, and another length of a mile or so in extent is about to be put in between Derby and Duffield.

RAILS FOR CHINA.—It is said that the Messrs. Krupp have secured a contract from the Chinese Government for the supply of 1,500 tons of steel rails, the price, including freight, being 25s. per ton below the lowest English offer.

MINERAL PAINT.—A deposit of mineral paint at Clifton, Tenn., is thought to be the largest in the world. It is said to be oily, of a venetian red color, and that it is better for iron or tin roofs than lead, as it sticks better. It is believed that several million tons can be mined at a cost of 50 cents per ton.

STEEL SLEEPER.—The steel sleeper in England, or steel cross-tie, as it would be called here, has brought a steel chair to the front, by Mr. Thomas, C. E., Brecon & Merthyr Railway. Its merit is extreme simplicity. Railway men of eminence—a correspondent of *The Engineer* says—speak highly of it; and, as steel sleepers are certain to become general, it comes to the front in the nick of time.

THE LITTLE MIAMI RAILROAD shops at Cincinnati are to be moved. The whole plant will be taken to Columbus, where a huge establishment is now being fitted up, and where all important repairs will be made, and all building done for the entire Pittsburgh, Cincinnati & St. Louis system. The railroad company bought a large amount of real estate in Columbus a number of years ago for a small sum, and will have the finest and most commodious railroad shops owned by any western road.—*Indianapolis Journal.*

STEEL SAW.—The firm of Wilhelm, Hartmann & Co., Fulda, Hessia, has introduced a new steel saw for cutting metals, the teeth of which are as hard as diamonds, whilst the blade remains as flexible as if of unhardened steel. It is reported favorably upon by the metal workers of Rem schied—the Birmingham of Germany. It not only cuts cast and wrought-iron and steel, but glass, and, as is claimed for it, keeps its edge infinitely longer than the very best saws ever yet produced. The firm is now turning its attention to making band saws for cutting out articles in iron, steel, etc.

PRICE OF LOCOMOTIVES IN EUROPE.—The lowest tender for the goods engines for the Italian Mediterranean Railway Company has just been accorded to the Austrian-Hungarian State Railway Company, at the price of 96½ cs. per kilo. (about 8½ cents per pound.) To show how prices have declined of late, it may be stated that two years ago a Vienna firm received for some locomotives, delivered to France, 1 f. 69 c. per kilo. (about 14¾ cents per pound), at which price a loss resulted, although, as will be the case now, a drawback of duty was allowed on all foreign materials consumed in their construction.

SINGULAR RAILROAD INCIDENT.—A probably unique but melancholy incident occurred in connection with the terrible smash which recently took place near Würtzburg on the Bavarian Railway, when two express trains ran full tilt into each other, namely: a guard, who had been on the line twenty-two years, on passing over it the following day, was so affected at the sight of the immense heap of wreckage, that on arriving two hours later at his destination he was seized with a "stroke," which necessitated his conveyance to the hospital, where he now lies in a precarious state, and will very likely not recover.—*The Engineer.*

PERMANENT WAY IN ENGLAND.—At the summer meeting of the Institute of Permanent Way Inspectors, held at Birmingham, recently, the President, Mr. W. C. Keeling, C. E., after speaking of the forms of permanent way in existence in different parts of the country, mentioned that the home railways were now nearly 19,000 miles in length. The rails, originally about 40 pounds per yard, were now nearly 90 pounds per yard, but the increase was due to the locomotive engines employed, which at first were very light, but now, with tenders, weighed 60 to 70 tons. The best kind of permanent way was that which, while being of sufficient strength, possessed the greatest degree of elasticity.

SKIDDING WHEELS.—In a paper read at the same meeting, "Upon the Wear of Wheels and Rails by the Action of Skidding Wheels," Mr. W. C. Meredith stated that the adoption of continuous brakes had already been found to have effected considerable economy in the wear of wheels and rails, and other parts of the permanent way; and, he was inclined to think, a not inconsiderable economy in the wear of wheels and rolling-stock generally.

THE MANCHESTER SHIP-CANAL.—The promoters of this work have failed in raising the required capital for carrying out this scheme. A subscription was put forward by the Messrs. Rothschild, but the public did not respond. The *Engineer's* correspondent says, "the check given by the temporary failure to find the £8,000,000 required for its construction is not regarded as likely to stop the ultimate result. Orders placed for tools and special machinery for the undertaking are being proceeded with all the same. Manchester has made up her mind that, if she cannot get the sea to her, she will go to the sea; and the battle has gone too far for the victors to be baulked on the point of reaping the reward of their labors."

PERMISSIVE BLOCK SIGNALS.—In concluding a report on the collision that occurred on the 5th of June at Edgeley Junction, which is about 700 yards at the southeast side of Stockport station, on the London & Northwestern Railway, Colonel F. H. Rich says: "The system of permissive block working, which allows two trains to be in the same block section, or to approach a junction at the same time, is dangerous. I consider that the margin of safety between the signal when a train should be detained until the junction or block section is clear and the fouling point should not be less than about 400 instead of 42 yards, as in the present case, and a much greater margin of safety should be provided when the trains are not fitted with good continuous automatic brakes."

THE INDIAN RAILWAY SYSTEM.—Some idea of the value and importance of the Indian railway system with its connected steamer services, may be gathered from the fact that the capital sunk in these undertakings is estimated at £161,917,840. Of this large sum the government has spent directly £82,255,391. The capital outlay of guaranteed companies stands at £71,032,838, and that of the "assisted" companies at £3,808,232. Native States —the principal in this respect being Mysore and Hyderabad—are responsible for an outlay of £4,821,379 on lines within their territories. When the construction of railways in India was first mooted, there were some who warned the projectors that caste prejudices would prevent the natives from using them; but it is an astonishing fact that last year Indian railways carried no fewer than 80,864,779 passengers, who paid for their fares £5,538,126. In 1884, the number of passengers was 73,815,119, and their freight was valued at £5,070,754. The chief income of most railways, however, is derived from their goods traffic, and in this respect the Indian lines yield more than double the receipts obtained from passengers. No less than 18,925,385 tons of goods were carried, the receipts from which amounted to £11,915,375. Both the tonnage transported and the return show an increase over the figures of the previous year, which was credited with a goods traffic of 16,663,007 tons, and receipts therefrom amounting to £10,565,941.—*London Times.*

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Principal Contents of this Number.

BOILER EFFICIENCY.

THE paper on "Flame Contact—a new Departure in Water Heating," which is published with this number of the RAILROAD JOURNAL, contains suggestions, with reference to the improvement of boilers, which promise some very important results. The author shows that the temperature of flame, in contact with one side of a plate which is covered with water on the other, is comparatively low; for the reason that the heat of combustion is communicated to the plate as fast as it is produced. From this it follows that the plate itself can never be very hot, and, inasmuch, as the conduction of the heat of the fire, on one side of the plate, to the water on the other will be in proportion to the *difference* in temperature on the two sides, it is obvious that the *rate* at which heat is communicated from the fire to the water will under such conditions be comparatively low. To overcome this difficulty Mr. FLETCHER, the author of the paper referred to, constructed "a copper vessel with a number of solid copper rods depending from the lower surface; each rod passed through into the water space and was flattened into a broad head, which gives up its heat rapidly to the water." The theory being that "the lower ends of the rods, not being in close communication with the water, can, and do attain, a temperature sufficiently high to admit of direct flame contact, and as their efficiency, like that of the water surface, depends on the difference between their own temperature and that of the source of heat in absolute contact with them, we must, if the theory is correct, obtain a far greater duty from them."

There seems to be a little flaw here, in the theory, because no account is taken of the fact that although the rate of conduction of heat is proportional to the difference in temperature, yet it is inversely proportional to the thickness of the plate, or the length of the rod by which it is conducted. It may be true that the lower ends of the copper rods, which the author has described, are heated to a much higher temperature than the plates, but it does not seem certain, as the author appears to assume, that they communicate heat to the water more rapidly than the bottom of his experimental boiler. It seems probable that there is more perfect combustion when the flame comes in contact with the highly heated rods, than results when it impinges against the cold surface of the plate, and that the cause for the difference in the efficiency of the two experimental boilers was due largely to the fact that more heat was developed by the gas burner in one case than in the other. It is true, of course, that some device similar to that which Mr. FLETCHER has experimented with would permit of a very large increase of heating surface in a boiler of a given size, and that in that way it may be possible to much more than compensate

for the retarding effect of the greater distance through which the heat must be conducted by the rods.

There can be no doubt, though, that it is desirable to prevent flame contact with cold surfaces, in order to produce perfect combustion, and that the two functions of combustion and the communication of heat to the water in a boiler should be carried on separately. During the process of combustion the temperature of the fire should be maintained as high as possible, and no heat should be taken from it until *after* the process of combustion is completed. When this is accomplished then the products of combustion may, without loss of economy, come in contact with cold surfaces.

It would follow then, from this reasoning, that it is desirable to extract as little heat as possible from the fire *in the fire-box*, and that we should aim to retain the heat there instead of conveying it to the surrounding heating surfaces, and that a large fire-box would be more economical than a small one, for the reason that the heating surfaces bear a smaller proportion to its grate area than they do in a small fire-box. When large fire-boxes have been used, however, the mistake has often been made of disregarding the importance of maintaining a fire of a high temperature. Slowness, it was thought, was more economical than intensity of combustion. The result was that very large grates were used, which admitted so much cold air that it was impossible to maintain a very hot fire. On the other hand, dead plates in the front, back and sides of fire-boxes have nearly always been found to be economical. There can be no doubt that their effect is to concentrate the draft, in a comparatively small area of the grate, and that it then acts somewhat as the blast does in a blacksmith's fire. The dead-plates also serve the purpose of keeping the flame and gases away from the cold heating surfaces on the sides and end of the fire-box, and they thus help to maintain a high temperature. It would, in fact, seem to be desirable to prevent the communication of heat from the fire until after the products of combustion *have left* the fire-box, and experiments which have been made with fire-boxes lined with fire-brick have shown economical results. Some years ago an engineer on one of the Hungarian State railroads, experimented with a locomotive boiler, which was constructed without water spaces around the fire-box, the latter consisting of a simple sheet-iron shell, lined with fire-brick. He showed very good results therefrom, but experienced some difficulty in keeping the tubes tight, owing to the high temperature of the fire. Some boilers were also built, a few years ago, with fire-boxes of this kind and were put in service on one of the lines of steamboats running from New York, and with very favorable results. For some reason, or perhaps without any reason, this method of constructing fire-boxes for locomotives has been condemned by nearly all locomotive engineers, without trial. There are certainly some very strong theoretical reasons to recommend it. Whether what appear to be the minor difficulties, which were encountered in the trials made by Mr. VARDEREBER on the Hungarian State railroads, can be overcome, only further experiments can decide. The promise of success is surely sufficient to justify further investigation in this direction.

COMPOUND LOCOMOTIVES.

RAILROAD managers should be interested in the account of the relative performance of simple and compound locomotives, an abstract of which is published on another page, and which shows an average saving of over 16 per cent. from the use of that kind of engines. Any one who has had experience in making experiments of this kind will, however, be very cautious about accepting the results, unless the circumstances under which the tests were made are known. Much depends upon the conditions under which the engines are worked, and the care which is taken to produce good results. A careful engineer and fireman can always save fuel with any locomotive, and if it becomes known on a railroad that those in authority are interested in having some engines do well, in comparison with others, the whole corps of employés will favor the favored engines, even if those in authority are disposed to be impartial. Therefore, experiments with locomotives on railroads when the officers are not interested in the improvement experimented with, have very much greater value usually, than they would have if made under the supervision of the author or inventor of the improvement experimented with.

Nevertheless, the tests of the performance of the compound engines referred to, seem to have been made very carefully, and supply strong *prima facie* evidence in favor of the economy of the compound system. As other testimony to that effect has been supplied from other sources, it would seem to be worth while for some of our American railroads to test the compound system. So much has been written (of which a considerable part is the product of ignorance and prejudice) concerning the relative merits of European and American locomotives, that it would seem worth while for some railroad in this country to make a trial of the compound system on a European-built locomotive. This could be done by simply ordering one from some European builder. Any of them would furnish an engine with a truck, and such other features as are here considered essential. The cost of such an experiment would not be very great and the risk very slight, because, in any event, the engine would do effective service or could be altered into a simple engine if it was not more economical than those now in use here.

EDITORIAL NOTES.

THAT railroad traveling is now safer than it was only a few years ago, was shown at a recent meeting of the shareholders of the Northeastern (of England) Railway. The chairman then reported that in 1870 "the compensation for damages," that is, for personal injuries to passengers, amounted to close on to £60,000. During the past six years the average amount paid was only £15,300 a year, and, for the half-year just ended, the sum paid was only £2,356. The chairman explained that this result was due to the institution of the block system, and also to "the great command over the speed and motion of their trains by the very liberal use of the Westinghouse brake."

* * *

M. TOMMASI, the French electrician, proposes to keep the foot-warmers used in European railway carriages up to a certain temperature by means of the heat due to an electric current traversing a high resistance. The current employed to maintain their heat is to be supplied by a dynamo driven off an axle of the train, and the circuit passes through the warmers. A simple device allows of the foot-warmer being thrown out of circuit should it become too hot.

* * *

IT is very much to be regretted that some competent person does not undertake to write, or at least to collect the material to write, a history of American railroads. There are still left a very few persons who were identified with the beginning of railroads in this country, but their number is lessened each year. There is also much valuable material destroyed, whenever one of the homes of the old veterans is broken up. Much is still left that can be saved, but a great deal has already been irrecoverably lost.

* * *

The Brotherhood of Engineers' Journal "conjectures" that there are 9,000,000 of workingmen in the country, and that only a third, or 3,000,000 of them, are members of labor organizations, and its editor "has no hesitancy in saying" that those who hold aloof are openly or covertly the enemies of labor organizations.

Art of Making Molds in Sand by Machinery for Castings in Iron or Brass. Peerless Manufacturing Company, Louisville, Ky.

This is a pamphlet printed in a most luxurious style, and contains a description and illustrations of the machines mentioned in the title. The engravings are admirably done, and all the mechanical work is of the very best. The description of the machine is, however, not easy to understand, as there is an entire absence of letters of reference in the description and engravings, so that it is impossible for the reader to tell what parts are referred to, and the description is not at all lucid. It is very much to be regretted that a catalogue which in other respects is so good should be lacking in the one essential of not being easily understood.

Street-Railways.

American Street-Railway Association.

President.—Julius S. Walsh, President Citizens' Railway Company, St. Louis, Mo.

First Vice-President.—William White, President Dry Dock, East Broadway and Battery Railroad Company, New York City.

Second Vice-President.—C. B. Holmes, President Chicago City Railway Company, Chicago, Ill.

Third Vice-President.—Samuel Little, Treasurer Highland Street-Railway Company, Boston, Mass.

Secretary and Treasurer.—William J. Richardson, Secretary Atlantic Avenue Railroad Company, Brooklyn, N. Y.

Office of the Association, cor. Atlantic and Third Avenues, Brooklyn, N.Y.

The Fifth Annual Convention of the Association will meet in Cincinnati, O., on Wednesday, October 20th, 1886.

REASONABLE HOURS OF SERVICE FOR STREET-RAILROAD EMPLOYES.

THE last annual report of the American Street-Railway Association contains a report of a committee on "Rules Governing Conductors and Drivers," and also a verbatim report of an informal discussion on street-railroad management, the reading of which leaves the impression that, while the lot of a street-railroad employé may be happy, it certainly is not an easy one. The report of the committee begins with the very general statement of the importance that good men should be selected and good rules adopted for their guidance. This is followed by a presentation of rules on "Discipline and Deportment," on "Comfort, Convenience and Safety of the Public," and on the "Collection of Fares," all of which indicate that the qualifications which are expected of such employés imply a very respectable degree of intelligence, and a character considerably above the average of human nature.

In the latter part of the report the committee says that drivers and conductors should be not only faithful but intelligent, and it is recommended that they be selected from among the residents of the city or town in which the road is located, and that *the pay should be sufficient to attract and hold such men, and their hours should be fixed within the bounds of reason.* All our readers will probably agree, that the committee's report would have had much greater interest and probably much more value, if they had defined what hours or daily period of service would be "within the bounds of reason." That is the rock against which conflicting opinions are perpetually striking, and it is owing to the fact that the views of those who are represented in the association referred to, and those employed by them are so irreconcilable, that there is so little peace between the two classes. If the advantages of our much boasted modern improvements are equitably distributed, it seems perfectly reasonable that workingmen to-day should work fewer hours than they did twenty-five or fifty years ago. Human labor has been made many

fold more productive by the discoveries, inventions and organization of modern times. That workingmen should demand that their burdens be lightened, is quite natural and reasonable.

Later in the meeting, the report of which has been referred to, the President of the association requested members to suggest subjects for reports and for discussion at the next meeting. If an intelligent and impartial committee of that association should make a full report on the question, "What hours of labor are within the bounds of reason?" it certainly would excite a great deal of interest, and if the officers of the different street-railroads in the country, who are represented in that association, should then discuss the report freely, fully and honestly, giving the true reasons why any given number of hours of service are essential to the welfare of street-railroad companies, it would be a very valuable contribution to the existing knowledge of that very much disputed subject. If those who would take part in such a discussion were frankly to admit the true principle by which they are governed in this matter, it is probable that it would be the same as that adopted by some managers of other railroads, which is to charge all "that the traffic will bear." There can be little doubt that in many cases somewhat the same principle has been applied to the men employed not only on street-railroads, but in many other places. It is the law of supply and demand, without any element of humanity added. Of course, there may be other reasons which control, and, perhaps, should control, the hours of service of employés, and which decide what is reasonable and what is not. No persons are so well able to present these reasons as the members of the American Street-Railway Association. By all means, then, let us have a report and discussion on the question—"What are reasonable hours of service on street-railroads?"

THE Sixth Avenue elevated road will soon be the only representative of the 10-cent tariff. The Third Avenue has reduced the fare on its line, and the vast population dwelling contiguous to its road will be able to ride from Battery to Harlem for 5 cents at any hour. What other city transportation can show a similar record?

* * *

IT is a curious fact, that wherever a street-railway had any business worth speaking of, and the proposition was made to reduce the fares, a wail of agony and dissent was sure to be raised by the managers and stockholders. Equally certain was it that when, with great reluctance the reduction was allowed, there has seldom been a desire on the part of the company for a restoration of the former high rates.

* * *

IF, as has been suggested, the cut in the fares on the elevated roads should be met on the part of the surface roads by a reduction to 3 cents, New York would stand at the head of cheap and rapid transit. Even now, no city is her equal, and if the Arcade Railway becomes a reality, she will be beyond the reach of rivalry.

The Philadelphia Cable Roads.

THE *New York Times* publishes the following account of the working of the cable lines in Philadelphia:

The Traction Company has now been operating its cable motor long enough to have overcome the difficulties which surrounded its first introduction, and to have made a thorough test of the system on its merits. If successful, its lines ought to be running smoothly, without interruption, and its stock ought to have shown a continued and continuous rise in market value Its plant ought to be in permanently good order, and its ordinary operation free from accidents which cause expense to the company and vexatious delays to the public. None of these conditions, however, have been fulfilled. Every one who uses the cable road knows that he may be carried to his destination quickly or that he may be subjected to a delay of uncertain length on account of the stoppage of the cable. A well-known wool merchant said of this: "I take a train at the Broad street station for my home late every afternoon. If I take a cable car up Market street, I may catch the train or I may not. Sometimes, when I have grown weary of waiting for the cable car that comes not, I have to walk over to Arch street and ride up that way. Sometimes, when I get started, the car suddenly stops half way, and I have to get out and walk."

It has been said that the Traction Company had been put to enormous and unexpected expense by reason of mistakes made in building their conduits—mistakes that even the extensive and costly repairs of last spring failed to retrieve. The entire conduit, it is said, has proved itself only a temporary structure, and its permanence can only be assured by rebuilding it with solid masonry. Other causes of depression were reports that the cables were constantly wearing out, and that six successive new ones had been secretly laid at night within a comparatively short time, and the suits brought against the Traction Company for the infringement of patents owned by the National Cable Railway Company and the inventor, Henry Root.

The Times's correspondent recently visited the engine house of the Market street line, at Twentieth and Market streets, accompanied by one of the officers of the Traction Company, and made a thorough examination of the machinery. No person except the officers and employés of the company is ever allowed to enter the engine house, whose secrets are rigidly guarded from the public. The secrets are interesting, and the heart of the cable system affords material for both entertainment and instruction. There are in the middle of the ground floor two great Corliss engines, each of 300-horse power, running at exactly the same rate of speed. The twin engines are beautiful results of the machinists' work, shining with brass and nickel trimmings and working with an oscillating movement. From their shafts rotary motion is given to two cog-wheels, which transmit the power to two larger

wheels mounted on shafting, which turn the gear wheels of the cables. These larger wheels are of different sizes. One propels the cable running east from Twentieth street to the river at the rate of 7.2 miles an hour, and the other runs the cable running west to the station in West Philadelphia at the rate of 9.1 miles. The eastern engine runs the western cable, and vice versa, the cables crossing under the street in front of the engine house. This arrangement reduces the distance which a car must run by its own impetus after releasing its grip from one cable and before its grip catches the other. When the cables leave the wheels, around which they are wound in grooves several times to prevent their slipping, of course they are at right angles to the street. They run at a downward angle, passing on their way two receptacles which drop upon them tar and boiled linseed oil. After this baptism, at a still lower level, they each reach a large iron wheel with a single groove, around which they are carried until they leave the vault of the engine house far beneath the street and parallel to its course. They rise upward until they rest upon the carrying pullies of the conduit, along which they travel on their long journey to the termini of the road and back again.

It was difficult to obtain at the engine house any exact figures concerning weights, measurements, consumption of fuel, or number of cars used. The employés, even in the presence of the officer of the Traction Company, talked very guardedly. The company's officer himself, however, volunteered a little information, as he stood looking at the cable that wound endlessly in and out of the building. "That cable," he said, "weighs 38 tons. It is made of the best crucible steel and costs 28 cents a foot. Its tension on these wheels, that is to say, the amount of resistance that must be overcome to move it, is 6,500 pounds. The cables were at first made for the company by the Roeblings at Trenton, but they are now made by the Hazard Manufacturing Company, of Wilkesbarre."

"Do they break often?"

"Well, it isn't so much their breaking that troubles us as their wearing out. You see, it is almost impossible to make so long a cable that is of exactly the same diameter throughout, and that is exactly round. Then, too, the grips, pressing on it here and there at irregular intervals affect its diameter. The curves the cable travels around help to wear it out. Before long a strand breaks, and then I'll show you what happens."

The officer led the way into the vault beneath the street, where the cable entered the engine house, and showed the apparatus for detecting a broken strand. The cable, after entering and before reaching the wheels turned by the engine, passes through a hole in a suspended iron bar. The hole is big enough for the cable to pass without striking, but as soon as the projecting end of a broken strand comes along, it strikes the bar and rings a bell. Then the engines are stopped, all the cars on Market street stand still and several hundred passengers fume at the delay, and a man in the engine house goes to work to remedy the trouble. This is done by cutting off the ends of the broken strand and tucking them snugly into the inside of the rope. This process occupies about 15 minutes; sometimes more, sometimes less.

"Suppose," was suggested, "a strand to be broken on a distant part of the cable, and that it ran through the grip of a car before reaching the engine house?"

"Oh, that often happens, and it causes us no end of trouble. When it does occur, the grip catches the strand, which coils around and around the grip, holding it tight and damaging a great many feet of the cable."

"What most frequently causes the cable to break?"

"Sometimes it breaks because it is worn out. Most frequently, however, such an accident is caused by a careless gripman's failure to release his grip when he comes to 'a vault.' 'A vault' is a place where the cable takes a sudden dip downward, being carried by pulleys below the reach of the grip, in order to cross another cable, or, as here in front of the engine house, where one cable ends and is carried down to be brought into the engine house. If the grip is kept tight at such a place, it is carried on until it strikes the point where the cable is carried downward. Then something has to give way. The cable can't be pulled up, because it is connected to a 300-horse power engine. The car can't very well be pulled down through the sidewalk. So, to solve the difficulty, the cable breaks."

"And what happens then?"

"Well, if the break is near the engine house, the loose end of the cable comes flying in here and thrashes round and round those wheels. If it should strike any one, goodbye, John! The engines are stopped as quickly as possible, and then the men set to work to splice the ends. That takes a long time, and sometimes as much as 60 feet of cable are used up in the operation."

"How long does it take to put in a new cable?"

"Oh, we can tie the end of a new cable on an old one and pull it through by the engines in a few hours. We usually do that at night. When a new cable is laid for the first time, as was recently done in the Seventh and Ninth streets line, two or three nights are needed, as it has to be dragged through by horses."

"How many new cables have been put into the Market street conduits this year?"

"Four, I think; but I won't be sure. However, when a cable is used up it is not, in one sense, the Traction Company's loss. The Traction Company has a contract with the Hazard Company, which agrees to furnish the cable for so much a month."

"But does not the Hazard Company ask a good round price for such a contract?"

"Yes, it does charge a good deal. If it could make a cable last eight months, it would receive twice as much money as the price of a new cable outright."

STREET-RAILWAY NEWS.

ALABAMA.

THE Milner Springs and Birmingham Street-Railway Company has been incorporated at Birmingham by E. Eastman, John Milner and others. Capital stock, $25,000.

ARKANSAS.

The Pine Bluff Street-Railway Company has commenced track-laying, and will have several miles of streets traversed by September.

COLORADO.

The electric railroad on Fifteenth street, Denver, is working satisfactorily. The car runs at about the speed of an ordinary horse-car, but the motion is steadier, and the stopping and starting can be performed in less time. The cars can attain a speed of fifteen miles per hour, and they will be run at this rate on the suburban lines where it is proposed to utilize them. It is claimed that the cost is only a fourth of that for operating with horses.

CONNECTICUT.

All the stock of the Meriden Horse-Railroad Company has now been subscribed for and work will be started at once.

ILLINOIS.

The Chicago Elevated Railway Company has been incorporated to build a line from Thirty-ninth street on the South side, to Lake View on the North side. John Tomlinson, James Bryant and A. C. Knapp, of Chicago, are the incorporators.

The Chicago Passenger Railway Company will experiment with a cable system.

At Springfield the Belt Railway Company has been organized by F. W. Tracy, with a capital stock of $10,000.

KANSAS.

A horse-railway is to be built at Salina. Mr. Herrington of that city can give particulars.

The Eureka Street-Railway & Bridge Company, of Dodge City, has been incorporated by H. L. Sitler and others. Capital stock, $25,000.

MAINE.

The Portland Railway Company has petitioned the Mayor and City Council for a fifty years' renewal of the location of the route, and the case will be given a hearing on September 6th.

MASSACHUSETTS.

Boston will have a new street-railway for close connection between the West End and Brookline; it will be owned by the West End Street-Railway Company.

The Meigs elevated one-rail line at Charlestown was given a test by the Board of Railway Commissioners, August 6th. Full-sized cars were run to and fro over the 1,800 feet of track, containing sharp curves and steep grades. The test was said to be quite successful.

The two principal street-railway companies in Boston, the Highland and the Middlesex, are to be incorporated as the Boston Consolidated Street-Railway Company. The capital will be $1,700,000.

At Lawrence a company has been organized to make electric engines to propel street-cars, under the patent of C. A. Jackson, of Haverhill. The capital stock is set at $1,000,000, and the company purposes to build its own shops.

The Citizens' Street-Railway Company, of Worcester, has opened its line from Franklin Square to South Worcester.

The Lowell & Dracut Street-Railway Company, capital stock $15,000, has been incorporated by Percy Parker and others.

MINNESOTA.

The Minneapolis Council's committee on railways has refused to grant a right-of-way for a street-railroad on Nicollet avenue, owing to the petitions of merchants, frontagers and persons using the street for driving.

The Baldwin Locomotive Works (Philadelphia) are making some soda motors which are to be used on the street-railways of Minneapolis.

MISSISSIPPI.

The Vicksburg Street-Railway Company contemplates running its cars by electricity.

MISSOURI.

At St. Louis a movement is on foot to unite all the street-railway companies in one general management, with a trust board composed of officials from the various companies.

A contract has been signed by street-railway companies and the owners of the "Terry" grip patents. It provides for an early test of the grip on an experimental track to be furnished by the companies, and for the sale of the rights to the city at a low cost. All the principal companies have entered into the contract, and if the test proves satisfactory, the system will be rapidly introduced on all the lines.

The Independence & Park Suburban Railroad Company has been granted the right-of-way on Independence avenue between Kansas City and Independence. The engineer is Mr. Knight, of Kansas City. It was originally proposed to use electricity, but it is now probable that steam motors will be employed.

At Kansas City the Metropolitan Street-Railway Company has been incorporated with a capital stock of $1,250,000, for the purpose of building and operating horse and cable railways in that and neighboring cities.

NEW JERSEY.

The Orange Cross-Town & Orange Valley Horse-Railway Company has received its franchise. The directors are: Francis M. Eppley, president; J. E. Browne, H. W. Pope, Peter A. Embury and others. Work will soon be commenced.

NEW YORK.

The Flushing & College Point Street-Railway Company, Brooklyn, has been incorporated by Henry Clement and others, with a capital stock of $60,000.

At Syracuse the Burnet Street-Car Company, capital stock $12,000, has been incorporated by Le Grand Sherwood and others.

OHIO.

The Lima Street-Railway Motor and Power Company has been incorporated by B. C. Faurant and others. Capital stock $50,000.

PENNSYLVANIA.

At Philadelphia, recently, the Union Electric Company gave an experimental test of their system on Ridge avenue. The track is similar to that for the cable system, the electric wires being laid in a conduit and connected by a "traveler" and wire with the motor on the car, through the slot. A speed of eight miles per hour was obtained and the motion was easy. The electrician is Mr. William M. Schlessinger.

The Pittsburgh, Knoxville & St. Clair Street-Railway Company will build an electric line from South Thirteenth street, Pittsburgh, to Mount Oliver, *via* Allentown and Knoxville; a length of two miles with grades up to 14 per cent. Thomas Evans is president; Henry Stamm, treasurer, and J. W. Patterson, secretary.

TENNESSEE.

The Chattanooga Belt Railway is to be extended to Ridgedale and other suburban points.

VIRGINIA.

A street-railway company has recently been chartered at Danville.

WISCONSIN.

A successful trial has been made of the Appleton electric street-railway.

The franchise, track and plant of the Eau Claire Street-Railway Company have been transferred to Albion G. Bradstreet, of New York (Bradstreet & Curtis bankers,), representing a new company, for $36,000. The road is said not to have been very profitable, and the fare has recently been reduced from seven to five cents. The new company will institute many improvements.

Manufactures.

THE ROGERS LOCOMOTIVE AND MACHINE WORKS.

(Continued from page 159.)

CHAPTER IV.

HISTORY OF LOCOMOTIVE BUILDING AT THE ROGERS LOCOMOTIVE AND MACHINE WORKS.

Soon after he commenced building locomotives Mr. Rogers became convinced that inside-connected engines, with crank-axles, were inferior in many respects to outside-connected ones, besides being more expensive to build and to keep in repair; he also became satisfied that in the matter of steadiness, the inside-connected had no advantage over the outside-connected engine, and that, with proper counterbalancing, the latter could be run as fast as required without any injurious oscillation; and also, that it required more skill to properly counterbalance inside-connected engines than outside ones. Therefore, he was an earnest advocate of this style of engine, and

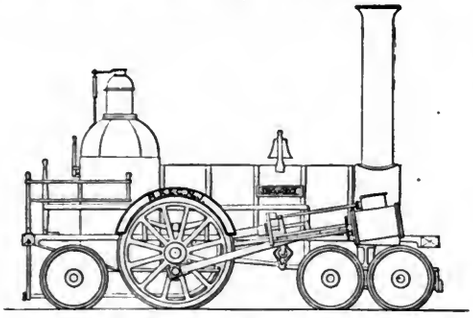


Fig. 15.

recommended outside connected-engines as better than inside-connected ones.

Fig. 15 represents the "Stockbridge," built in 1842, with outside cylinders. In this engine the driving-axle was placed in front of the fire-box and a pair of trailing-wheels behind to carry the overhanging weight. The load on the driving-wheels was, of course, reduced by an amount

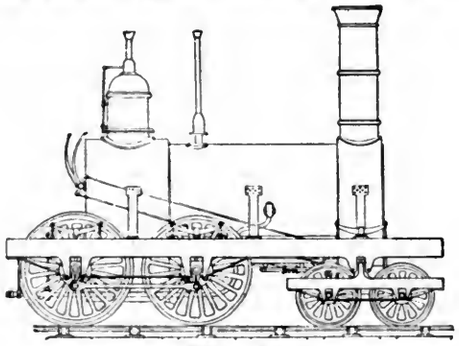


Fig. 16.

equal to that carried by the trailing-wheels, so that this type of engine was also deficient in adhesion and power.

The next step which was made was to substitute a pair of driving-wheels for the trailing-wheels, and couple them with the main driving-wheels. This form of engine, shown by Fig. 16, was patented in 1836 by Henry R. Campbell, of Philadelphia, and was adopted by Mr. Rogers in 1844. This plan has since been so generally adopted in this country that it is now known as the "American" type. Fig. 17 represents an engine of this kind built at the Rogers Works in 1844. It had four coupled driving-wheels and outside cylinders, the eccentrics were on the back axle, the pumps were full stroke,

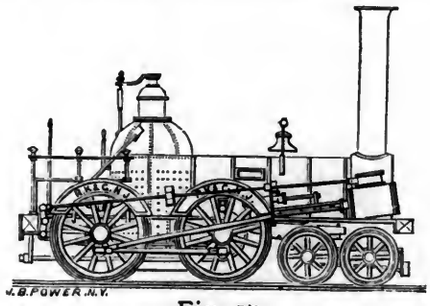


Fig. 17.

worked from the cross-heads. It had springs over the back axle bearings, and also in the centre of the levers which extended from the driving-axle to the centre of the truck on each side of the engine. The truck was pivoted and turned upon a centre pin fixed to the boiler; the arrangement did not give satisfaction, and was altered after a short trial. This engine was remarkable from the

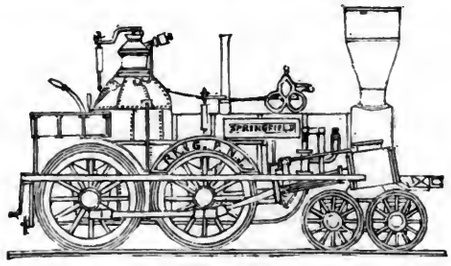


Fig. 18.

fact that it is the first example of the use of an equalizing-beam between the driving-wheels and truck.

The engine shown by Fig. 18 was built in 1845, and had equalizing-levers between the driving-wheel springs; the truck had side bearings and springs over the sides of truck; the pumps had short stroke and were worked from the cross-head, as shown.

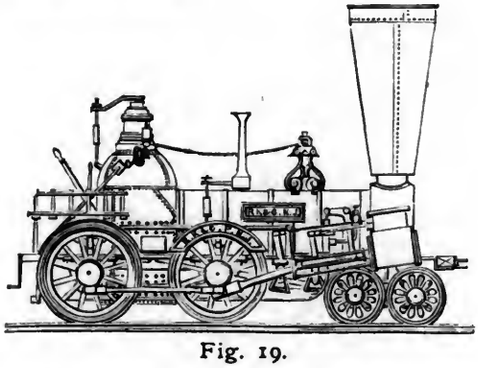


Fig. 19.

Fig. 19 shows an engine built in 1846 with the driving-wheels spread well apart. It had V hooks and independent cut-off on the back of the main valves; this was a favorite kind of engine for many years.

In 1884, Mr. Rogers was requested to furnish some engines with six-coupled wheels for the Savanilla Railroad in Cuba. He then designed and built the first ten-wheeled

engines ever made at the Rogers Works. There is no drawing of these engines extant. They had, however, outside cylinders 15½ inches diameter by 20 inches stroke. The ten-wheeled engines which had been built previous to this time had inside cylinders and crank axles. The connecting rods of the engines for the Savanilla Railroad

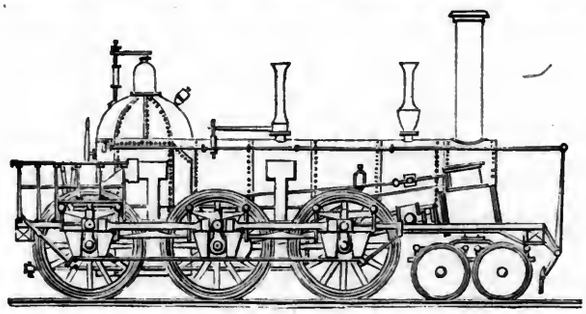


Fig. 20.

were made to take hold of the outside journal of the main crank-pin, which at that time was a new departure.

Fig. 20 represents a plan of ten-wheeled engine, with half-crank keyed on the driving-wheel, same as Baldwin's plan. This pattern of engine was built in 1848 after those for the Savanilla Railroad. The engine had outside bear-

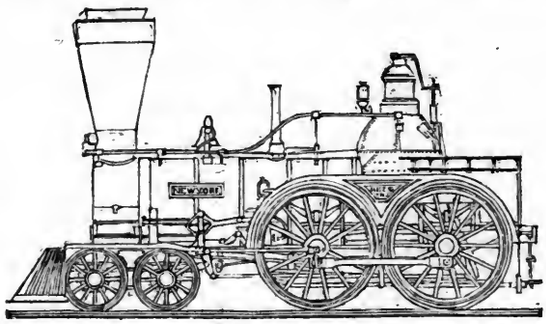


Fig. 21.

ings and equalizing-levers between the springs; it also had cranks on the axles outside the frames to which the coupling-rods were attached. A number of engines on this plan, with cylinders 17 × 22, were built for the New York & Erie Railroad. They all had independent cut-off valves.

Fig. 21 represents an inside-cylinder engine with full crank; the steam-chests were inclined sidewise, so that the valves could be readily got at. This was one of the improvements introduced by Thomas Rogers. The engine had V hooks and independent cut-off valves, and was built for the Paterson & Hudson River Railroad.

On the style of engine shown by Fig. 22, the shifting-link motion was introduced. Thomas Rogers was one of its earliest advocates, and did more towards its successful introduction on American locomotives than any other person. He was not only an early, but an earnest advo-

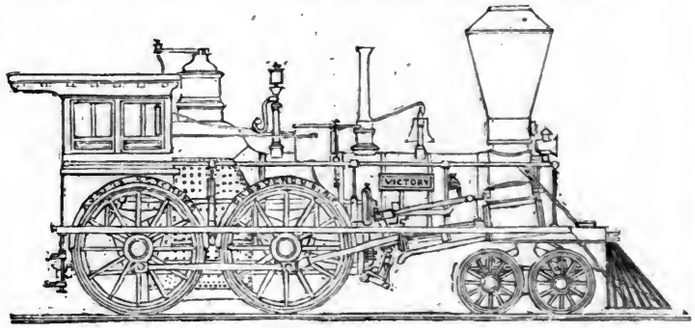


Fig. 22.

cate of it, at a time when it was condemned by some of the most prominent engineers in the country. Time has amply proved all that he claimed for it, which was, that it is the most simple and efficient form of valve-gear that has ever been devised.

Fig. 23 represents a style of passenger engine which was

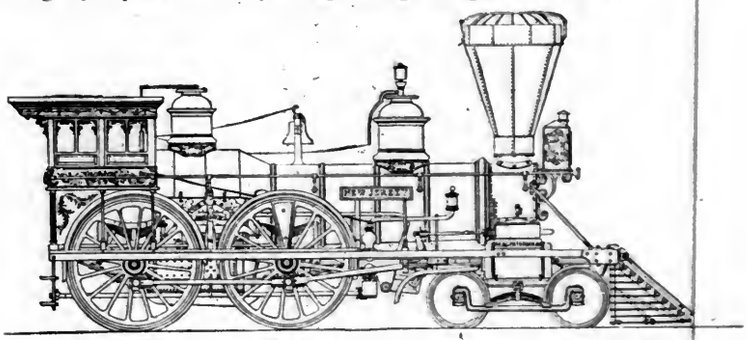


Fig. 23.

first built in 1852. It had 15 × 22 inch cylinder, driving-wheels 5 feet in diameter. It had what may be called supplementary outside frames, which carried the running-board, cab, etc. It had shifting links, hung from below, and the truck axles had both inside and outside bearings.

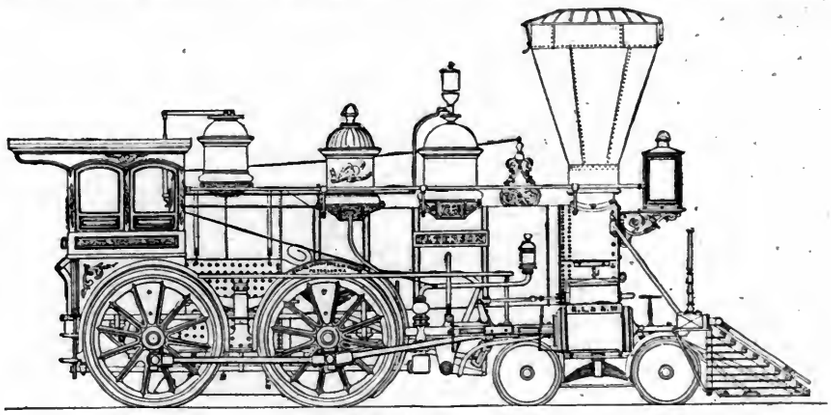


Fig. 24.

The form of engine represented by Fig. 24 was first built in 1853, and was for a long time very popular. The cylinders were 16 × 22 inches, and the driving-wheels 5 feet diameter, although the size of the latter was varied somewhat in different engines.

(*To be continued.*)

New Inventions.

Hirsh's Freight-Car.

MORRIS M. HIRSH, of Chicago, Ill., is the inventor of a new and improved form of freight-car, the construction and operation of which is herewith illustrated and described.

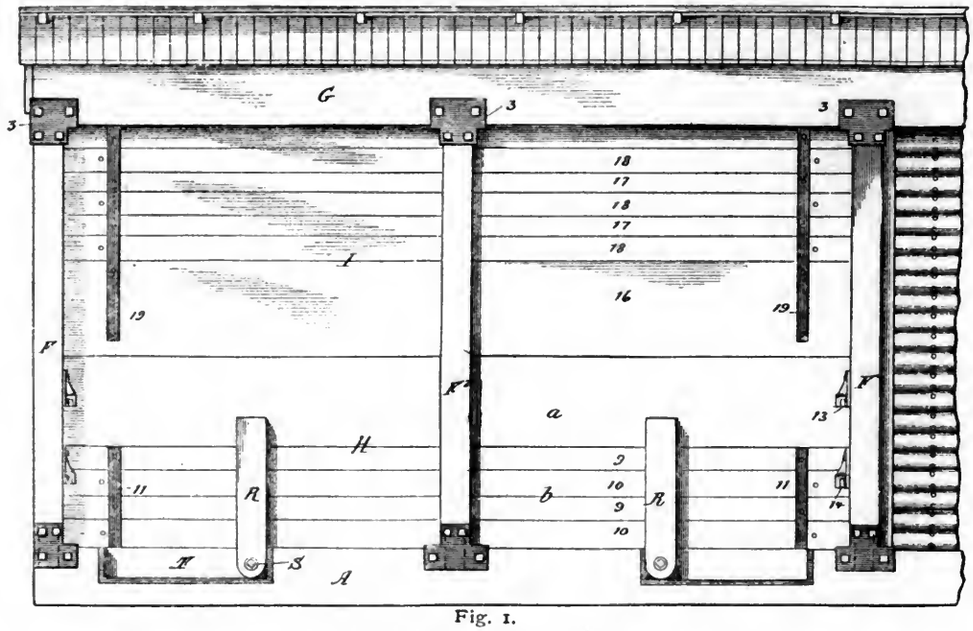


Fig. 1.

HIRSH'S FREIGHT-CAR.

This invention has for its object the construction of a freight-car that can be converted from a box-car into a cattle-car, a coal or gravel-car, or into a platform-car; and it consists of the novel devices and combinations of devices hereinafter described.

In the accompanying cuts, Fig. 1 represents a side elevation of the box-car; Fig. 2, a longitudinal vertical section through the center of the same; Fig. 3, a transverse vertical section through either end of such car; Fig. 4, a transverse vertical section through the center of the same; Fig. 5, a transverse vertical section through either end of the car as converted into a cattle-car; Fig. 6, a longitudinal vertical section through the center of such car as converted into a coal or gravel-car; Fig. 7, a transverse vertical section through either end of the same as converted into a coal or gravel car; and Fig. 8, a transverse vertical section through either end of such car as converted into a platform-car.

A A′ A^2 A^3 denote the longitudinal floor-beams of the

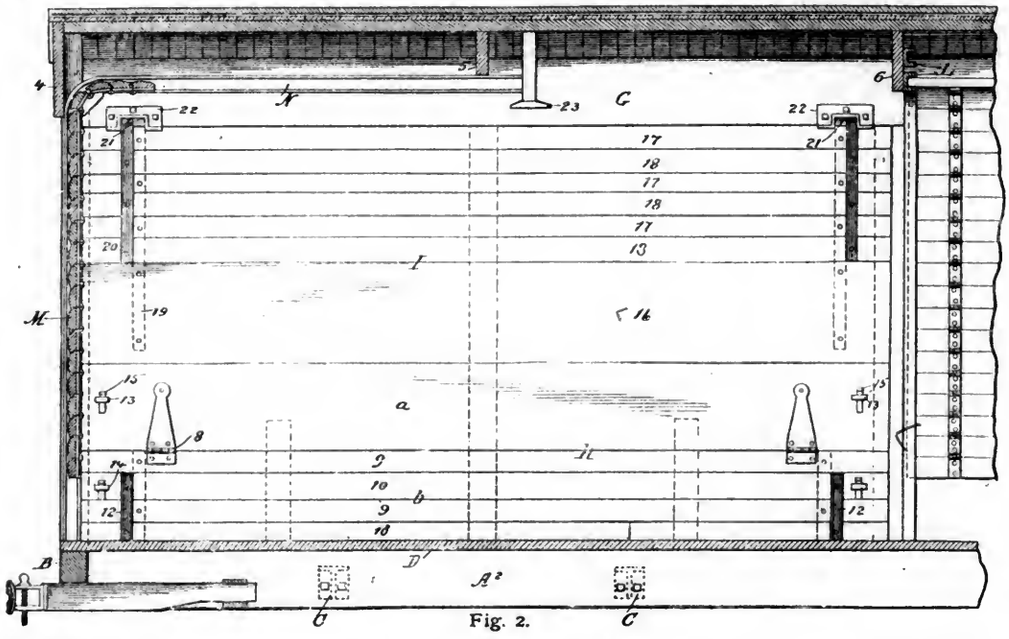


Fig. 2.

HIRSCH'S FREIGHT-CAR.

car-body, which are rigidly connected by end beams B, and again the beams A and A′, as well as the beams A^2 and A^3, are transversely connected by a series of iron brace-bars C. Upon the beams A′ and A^2, is rigidly

secured a floor D, which covers the space between such beams, and the spaces between A A′ and A² A³, are covered by trap-doors E E′, which by hinges are pivotally connected to the rigid floor D, in manner that such doors will form a continuation of such floor D. F are the cor-

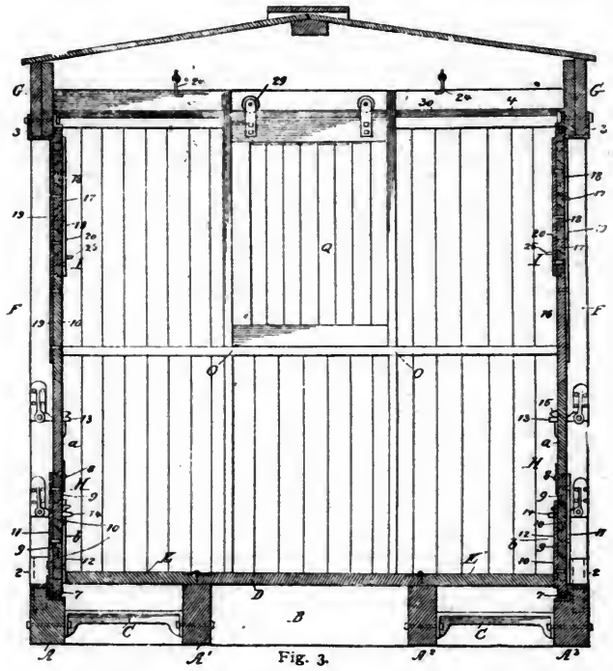


Fig. 3.

HIRSH'S FREIGHT-CAR.

ner-posts, F′ the door-posts, and F² intermediate posts tenoned into iron-socket castings 2, that are rigidly secured upon the longitudinal beams A A³, and upon these posts F F′ F², are secured by suitable castings 3, the longitudi-

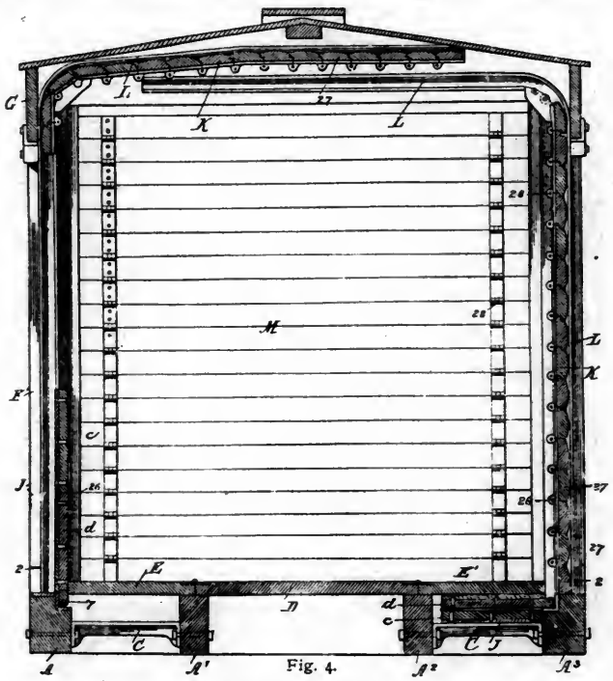


Fig. 4.

HIRSH'S FREIGHT-CAR.

nal beams G, framed together by end beams 4, and by intermediate roof-plates 5 and 6.

The roof for this car may be constructed in any well-known manner, and the sides between the corner-posts F, and door-posts F′, are closed, each such opening by a lower section H, and an upper section I, such sections forming a tight joint at their meeting line. The section H, is pivotally secured by hinges 7, to form a tight joint with the rabbeted inward upper edge of the floor-beams A or A³. Each section H, is again divided longitudinally on its center line into two sub-sections *a* and *b*, that are pivotally secured together by strap-hinges 8, in a manner that the sub-section *a*, can be folded upon the sub-section *b*, and that both sections thus folded can be turned down into the spaces between beams A and A′, or A² and A³, to rest upon iron braces C, and when down to be covered and concealed by trap-doors E E′. The lower sub-section *b*, is composed of longitudinal bars 9 9, and 10 and 10, that form rabbet-joints with each other. The bars 9 9, are secured to exterior upright bars 11, and the intermediate bars 10 10, which close the interstices between bars 9 9, are secured to interior upright bars 12, each two such bars 11 and 12, being pivotally connected to one of the socket-castings 2, by a single hinge *l*, that forms part of such

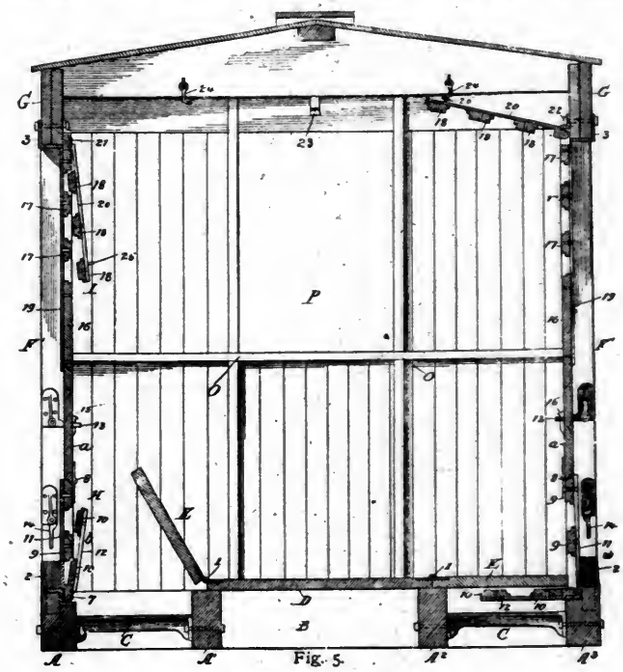


Fig. 5.

HIRSH'S FREIGHT-CAR.

socket-casting. With this construction, as will be seen the bars 10 10, thus independently connected, can be turned down into the spaces below the trap-doors E E′, thereby providing openings between the bars 9, for ventilation and light, which will be desirable for transporting cattle or other live-stock. To posts F F′, are secured plates that have pivoted latches 13 and 14, which latches pass through holes in sub-section *a*, and in one of the bars 10, for rigidly fastening such parts on their upright position by keys 15, passed through slots in the ends of such latches.

The sections I, forming the upper half of the side walls of the car-body, are composed each of a solid part 16, and of bars 17 and 18, that form rabbeted joints with each other. The solid part 16, and the bars 17, are rigidly secured to vertical bars 19, and the bars 18, which close the interstices between bars 17, are secured to vertical bars 20, and each two such bars 19 and 20, are suspended by a single hinge 21, formed to a casting 22, secured to beam G. With this arrangement each entire section I,

can be swung under the roof of the car, to be securely held on its upturned position by a turn-buckle or other fastening 23, and when using such car for transporting cattle the bars 18, with their connecting-bars 20, can be swung up alone for ventilating and lighting purposes, and suspended to the roof of the car by hooks 24, engaging with eyes 25, of bars 20. The lower portion of the openings between door-posts F′, are arranged to be closed for grain, coal or gravel transportation by doors J, each composed of two sections *c* and *d*, connected by strap-hinges 26, and the section *d*, again being pivotally coupled to post-sockets 2, by hinges 7, all in the same manner as described for section H, to fold such doors into the spaces

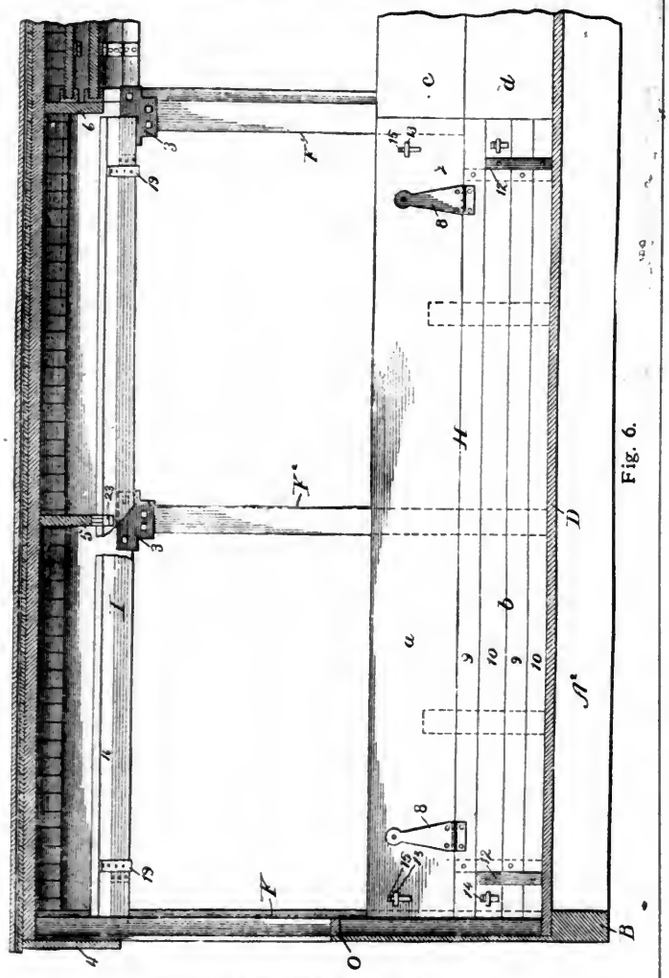


Fig. 6.

HIRSH'S FREIGHT-CAR.

between the floor-beams A A′, or A^2 A^3, where they are covered by trap-doors E E′, when not required.

For closing the entire openings between posts F′, doors K, are provided, composed of slats 27, secured together by hinges 28. These slats move between channel-iron guide-grooves L, that are secured against the posts F, and are curved at the top end of these posts, to be continued under the roof of the car on a horizontal line, where these channel-bars are secured to roof-plates 6, and for the two opposite doors, when both opened to clear each other, their guide-bars are placed on different elevations against such roof-plates. The ends of the car are provided with doors M, constructed like doors K, and guided between channel-bars N, which are secured against the corner-posts, to be continued on a horizontal line, where such channel-bars are fastened against the inward faces of longitudinal beams G, all as shown by Figs. 2, 4 and 7. Instead of using doors M, the end of the cars can also be closed by a frame-work O, that divides such end area into panels which are closed by planking, and in one of the

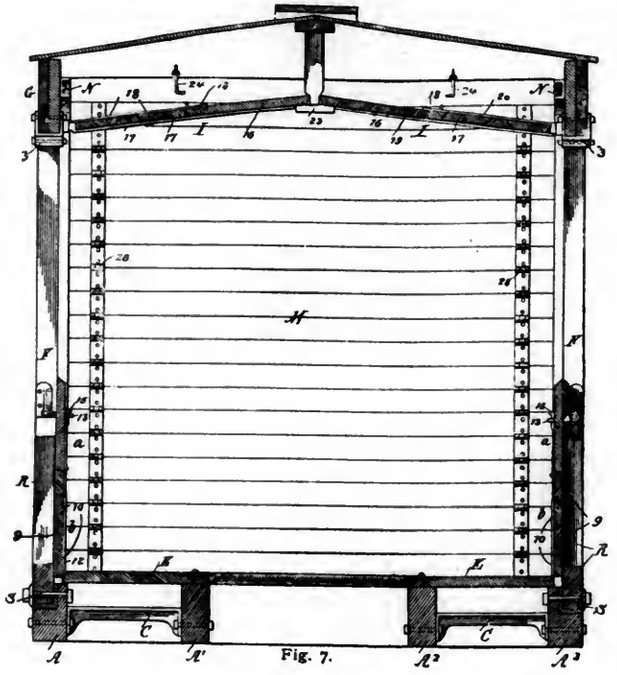


Fig. 7.

HIRSH'S FREIGHT-CAR.

panels P, is left an opening to be closed by a sliding door or shutter Q, suspended on rollers 29, that ride upon a bar 30, all as shown in Figs. 3, 5 and 8. For better sustaining the sections H, of the side walls of the car, particularly

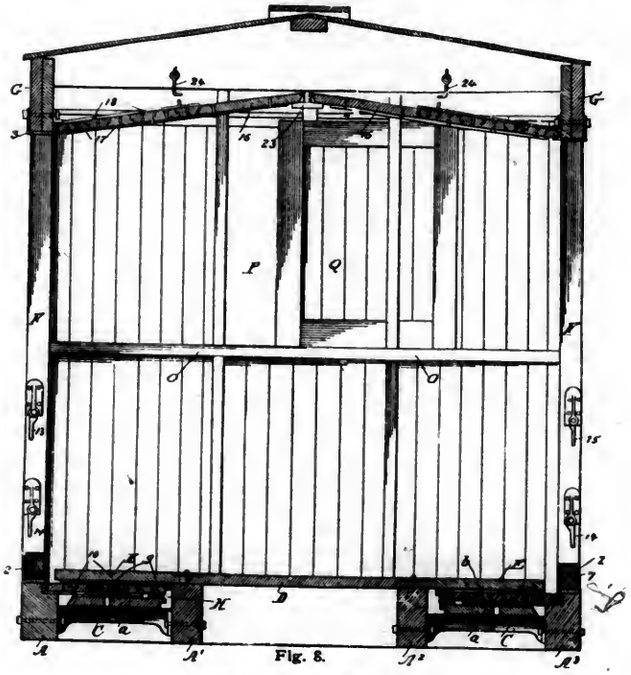


Fig. 8.

HIRSH'S FREIGHT-CAR.

when such car is used for carrying coal or gravel, standards R, are provided, placed intermediate of posts F F′ F^2, such standards R, being pivotally secured by bolts S, into exterior notches T, of beams A A^3, in a manner that

when such car is converted into a platform-car such standards can be turned into such notches T.

As shown by Figs. 1, 2 3 and 4, the car is completely closed from all sides and ends, the same as a box-car; but when desired to be used as a car for transporting cattle or other live-stock the bars 10, with their hinge-bars 12, are turned under the trap-doors E E′, and the bars 18, with their hinge-bars 20, are suspended to hooks 24, all as shown in Fig. 5. For changing the car to be suitable for the transportation of coal or gravel, or other material of a like nature, the bars 10, are replaced to their upright position, the entire sections I, are swung under the roof, and are secured on their elevated position by turn-buckles 23, and the vertical sliding doors K, are shifted up to be under the roof, all as shown by Figs. 6 and 7; and for changing the car into a platform-car the sub-sections *a* and *b*, of sections I, and the sub-sections *c d*, of doors J, are folded and turned under the trap-doors E E′, and the standards R, are turned down into the notches T, all as shown in Fig. 8.

The above devices, it will be seen, produce a freight-car that contains all the parts necessary to be adaptable for carrying any kind of freight, and that is strong and durable in its construction. This car is also well adapted for a railway-inspection car, since either side or end can be opened for the officers to examine the condition of the tracks.

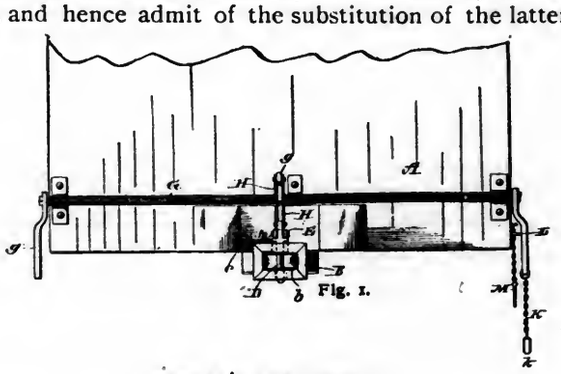
The special merits appertaining to the above-described invention lie in the various uses to which this form of car can be put; with the readiness and ease of alteration to adapt it to the desired purpose, and consequent economy in expense.

The device is under the control of the patentee, Morris M. Hirsh, No. 2585 Archer avenue, Chicago, Ill., to whom all inquiries and communications should be addressed.

Wooley's Car-Coupling.

CHARLES D. WOOLEY, of Walden, N. Y., is the inventor of a new and improved form of car-coupling, which is herewith illustrated and described.

The object of this invention is to provide a coupling which shall consist, essentially, of an ordinary link and pin, and hence admit of the substitution of the latter in

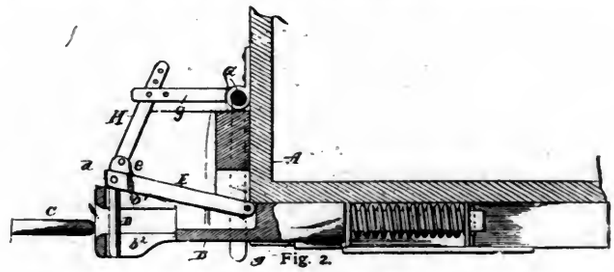


WOOLEY'S CAR-COUPLING.

case of accident or in coupling cars of other roads thereto. A further object is to provide a coupling which shall be automatic in its action, and which will admit of the entering-link being guided by the operator without danger to himself; and also to provide a coupling which may be locked in coupled adjustment against any accidental or intentional displacement, except by breaking or the consent of the operator.

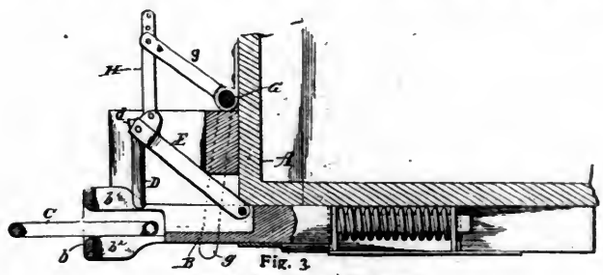
In the accompanying drawings, Fig. 1 is a view of one end of a car provided with the coupling; Fig. 2 is a longitudinal vertical section through the draw-head and approaching link; Fig. 3 represents the position of the pin after it has been tilted by the approaching link and is about to be raised, and Fig. 4 shows the link in a position to be operated upon by the guide-arm.

A represents the end of a car, to which the draw-head B, is secured in any well-known or approved manner. The draw-head B, is provided with a bell-mouth, as is usual, the under lip *b*, being rounded or beveled to admit of the link C, hanging down in an oblique position when



WOOLEY'S CAR-COUPLING.

left to itself therein, but furnishing a bearing which will act as a fulcrum for elevating the free end of the link by bearing down on its end within the draw-head. The draw-head is further provided with an extended longitudinal vertical slot *b′*, in its upper side, and with a corresponding elongated slot b^2, in its lower side for the reception of the coupling-pin D. The coupling-pin D, is of the same general form as that in common use in the ordinary form of pin-and-link coupling, excepting that its head *d*, is reduced and extended to form points of attachment for the guide and operating-arms E and F. The guide-arm E, is pivotally secured to the head of the coupling-pin a short distance below its upper end, the end of the arm E, being preferably bifurcated, as shown



WOOLEY'S CAR-COUPLING.

at *e*, to receive the head of the pin between its branches. The opposite end of the arm E, is pivotally secured to the draw-head at a distance from back its mouth. The back of the squared portion of the pin D, is so arranged as to engage and come in contact with the lower edge of the rear wall of the jaw formed by the bifurcated end of the arm E, when the lower end of the pin has been tilted back from the mouth of the draw-head sufficiently to allow the end of the link to force it upwardly by horizontal pressure.

An operating-shaft G, is journaled in suitable bearings across the end of the car, and provided with an operating-

arm g, which extends over the draw-head, its free end being about over the position which the pin would naturally occupy when in coupled adjustment. The free end of the arm g, is connected with the upper end of the pin by a link or other suitable connection H. The ends of the operating-shaft G, are provided with handle-arms g', for rocking the shaft G, from either side of the car. The end of one of the arms g', is provided with a chain K, having a link or eye k, adapted to be placed over a staple L, in the side of the car, and a pin or padlock M, is adapted to secure the chain to the staple, and hence prevent the movement of the arm g', and operating-shaft G. The coupling-link C, is of the ordinary elongated form in common use. The parts are so arranged that the arms g', on the ends of the operating-shaft will tend to hold the coupling-pin in coupled position in the draw-head by heir gravity, requiring to be swung away from the end of the car to elevate the pin or uncouple.

The approaching link when it first engages the coupling-pin will tilt it until the back of the squared portion thereof comes in contact with the lower edge of the rear wall of the jaw, as before described, when the continued pressure will lift the pin and allow the link to slide beyond it in

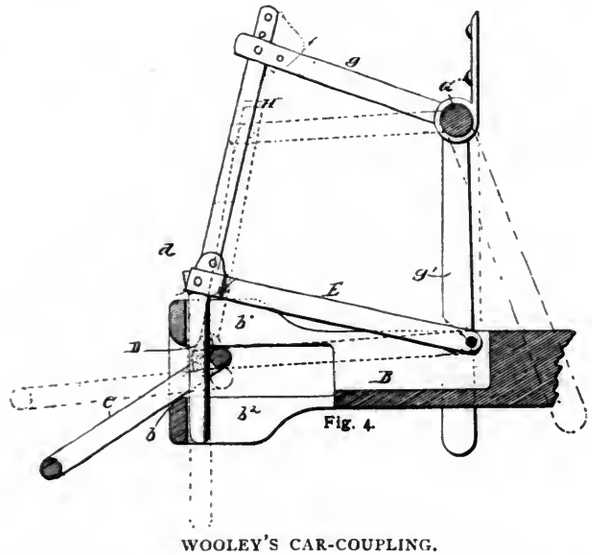


Fig. 4.

WOOLEY'S CAR-COUPLING.

the draw-head. The weight of the pin and arms E, g and g', will tend to automatically return the pin to its coupled position, and the coupling will be complete. The link, resting in the approaching or stationary draw-head, may have its free end elevated or depressed by rocking the shaft G, and thereby causing the guide-arm E, to press heavily or lightly on the end of the link within the draw-head. This manipulation of the link from the side of the car or out of the way of danger is an important advantage, while a chain may be connected to the end of the connecting-bar H, and carried thence to a staple at the edge of the car-roof, thus allowing uncoupling from that position.

The form of coupling shown and described may be applied to either freight or passenger-cars, but is well adapted to use on freight-cars. In case of accident or possible derangement, an ordinary link and pin can be substituted without delay, and a stray car on any other road could be coupled with any other car where the ordinary link and pin are used.

It is evident that the means for operating the pin might be somewhat varied in form and arrangement to suit different forms of cars without departing from the spirit and scope of the invention; hence it is not limited strictly to the construction herein set forth.

It is claimed for this form of car-coupling that it is equally well adapted to application to different forms and styles of cars; and will work with perfect ease either on grades or curves.

The device is under the control of the inventor, to whom all inquiries and communications should be addressed.

Waters' and Sweeny's Electrical Switch.

EDWARD G. WATERS and ROBERT G. SWEENY, of Terre Haute, Ind., are the inventors of a new and improved electrical switch, the construction and operation of which is herewith illustrated and described.

The object of this invention is to produce a switch by which any one of several telegraph or other lines may be connected with a single instrument at pleasure. This object is accomplished by connecting the several lines to a series of contact-springs which are arranged radially to a central hub carrying two points which are electrically connected with the two binding-posts of the instrument, each wire of the several lines being connected to one of said contact-springs, and the contact-springs connected to the incoming wires of each circuit being arranged to come in contact with a part or strip connected with the outgoing line-wire when not separated therefrom by the contact points on the revolving hub.

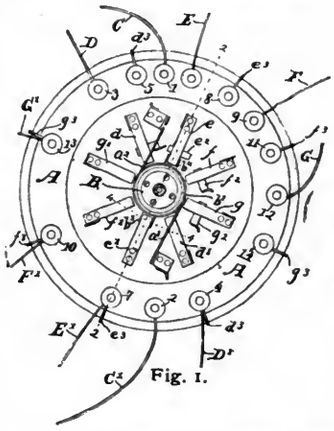


Fig. 1.

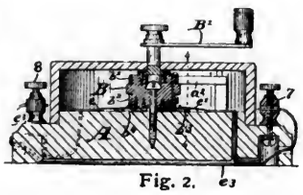


Fig. 2.

WATERS' AND SWEENY'S ELECTRICAL SWITCH.

In the accompanying cuts, Fig. 1 is a top or plan view of a switch embodying the said invention, the casing or cover portion being removed; Fig. 2, a central vertical section on the dotted line 2 2 in Fig. 1; Fig. 3, a detail elevation of the hub as seen from the dotted line 4 4; and Fig. 4, a plan showing the electrical connections.

A represents the base of the switch; B, the hub; C C', the incoming and outgoing instrument wires, respectively; D D' E E' F F' G G', the incoming and outgoing wires of several electrical circuits or main lines, and H, the electrical instrument. The base A, is formed of wood or some other non-conducting material, and carries the hub, contact-springs, binding-posts and contact-strips, as shown. The hub B, is centrally mounted on the base, and revolves thereon, a crank B', being provided as a means of turning

it. Its body is formed of non-electrical material, and it carries two rings b' b^2, one of which is connected to one of the instrument wires and the other to the other by contact-springs a' a^2. These rings are also connected to the contact-points b^3 b^4, and may, by means of said contact-points, be also connected with either of the line-wires, as will be hereinafter more particularly described.

The operation of the device may be described as follows: Supposing that the operator desires to use the line E E', he will first turn the hub B, until the contact-points b^3 b^4, have passed underneath and are in contact with the contact-springs e e', which form terminals for said wires, which at the same time raises the contact-spring e, away from the strip e^2, and breaks the independent circuit outside of the instrument. The course of the current is then in from the line-wire E, through its binding-post 6, to the contact-spring e, thence, by the contact-point b^4, the ring b^2, and the contact-spring a^2, through the binding-post 1, to the wire C, over the wire through the electrical instrument H, and back over the wire C', to the binding-post 2; thence to the contact-spring a', to the ring b', and to the contact-point b^3; thence, by the contact-spring e', to the binding-post 7, and out over the outgoing line-wire E'. Meantime each of the other electrical circuits or main lines are uninterrupted, and the course of the current is as follows: A current comes in over the main line D, to the binding-post 3; thence to the contact-spring d, to the contact-strip d^2; thence to the binding-post 5; thence across underneath the switch, by the loop d^3, to the binding-post 4, and out over the wire D'. A current comes in similarly over the wire F, to the binding-post 9; thence to the contact-spring f, to the contact-strip f^2; thence to the binding-post 11; thence across underneath the switch by the loop f^3, to the binding-post 10, and out over the wire F'. A current comes in similarly over the wire G, to the binding-post 12; thence to the contact-spring g, to the contact-strip g^2; thence to the binding-post 14; thence across underneath the switch by the loop g^3, to the binding-post 13, and out over the wire G'.

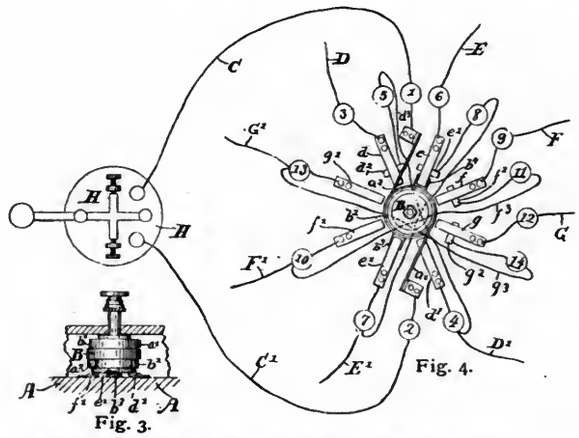


Fig. 4.

Fig. 3.

WATERS' AND SWEENY'S ELECTRICAL SWITCH.

When the operator desires to use another line, the hub is turned to bring the contact-points b^3 b^4, into contact with the contact-springs of the line desired, and the current then passes over the line E E', similarly to the course above described, bringing the binding-post 8, and loop e^3, into service, as will be readily understood. It will also be readily seen that the contact-springs d' g' and f', will perform similar service, when their respective main lines are brought into use, to that described in connection with the description of the course of the current over the line E E', as performed by the contact-spring e'. It will be understood, of course, where contact-springs, contact-strips, and contact-points are referred to, that these may be any ordinary means of contact which will accomplish the result; springs, points and strips being shown and described merely as the preferable or more convenient construction. In order to cut out the instrument from all the circuits, it is only necessary to so turn the hub that the contact-points will be between some of the several contact-springs, without touching either, when all of the circuits will be similar to that just described.

As will be readily seen, by the use of this invention a single telegraphic or other electrical instrument may at will be put in circuit with either one of any number of lines, and thus the expense of separate instruments for each line can be saved, as well as the room which they would occupy if used, thus making the invention especially valuable for such places as a superintendent's office of a railroad, which officer usually desires to have a telegraphic instrument on his desk, with which he can communicate with either of several officers or places at pleasure, but which it has not been practicable to do where the complete telegraphic outfit was used with each line. When this device is employed, a relay can be used with each of the several lines which will permit calls to be heard, while the key and sounder only need be placed on the desk of the operator.

It is claimed for this invention that it is simple in its operation and application, and durable in construction; while its multiplex character renders it a most useful and economical addition to telegraphic systems. All inquiries and communications appertaining to the patent should be addressed to Edward G. Waters, No. 613 Mulberry street, Terre Haute, Ind.

Mott's Railway-Signal.

ELIAS HICKS MOTT, of Sangerfield, N. Y., is the inventor of a new and improved form of railway-signal, which is herewith illustrated and described.

This invention relates to improvements in signals for use on railway tracks at crossings and the like; and the novelty consists of the peculiar construction and combination of parts, substantially as hereinafter fully set forth.

The primary object of this device is to provide an improved signal which is automatically operated by a passing train to give an audible alarm for the purpose of warning persons and teams of the approach of the train. A further object of the invention is to provide mechanism which shall be ready for action at all times; which shall not be liable to become broken by the car-wheels; which shall be simple, strong, and durable in construction, thoroughly effective in operation and comparatively cheap.

In the accompanying cuts, Fig. 1 is a view in side elevation showing the improved apparatus applied to a rail of a track; Fig. 2 is a vertical cross-sectional view through the track-rail on the line x x of Fig. 1; Fig. 3 is an enlarged view, in detail, of audible-alarm device; and Fig.

4 is a detail view of a modification. Figs. 5 and 6 are enlarged detail views.

A designates one of the rails of a railway-track to which the improved automatic signal devices B, are applied at any convenient and desired point—as, for instance, where a road or street intersects and crosses the track. C C designate two longitudinal bars, which are pivotally or loosely connected directly together, or by means of an intermediate (link shown in detail in Fig. 5), and the bars are located parallel with and inside of one of the rails of

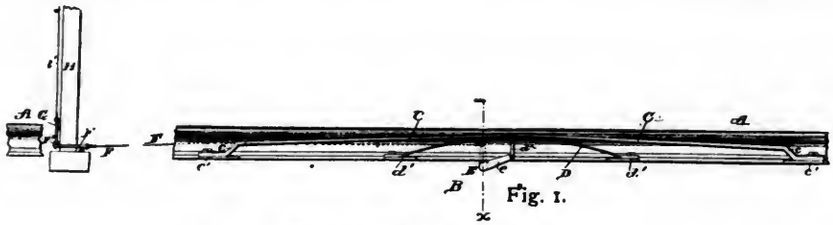


Fig. 1.

MOTT'S RAILWAY-SIGNAL.

the track, the ends of said bars being bent, as at *c*, and provided with slots, through which are passed bolts to loosely connect the bar to suitable supports *c'*. The opposite free ends of the side-bars are brought together and lie in a plane just below the upper surface of the head of the rail A, and these meeting ends of the side-bars are loosely connected to a curved spring D, in any suitable manner; or they may be left free of the spring and merely rest thereon. These bars are acted on successively by the car-wheel flanges of a passing train to operate the audible or visible alarm devices.

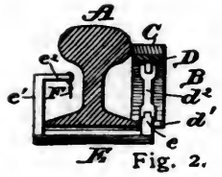


Fig. 2.

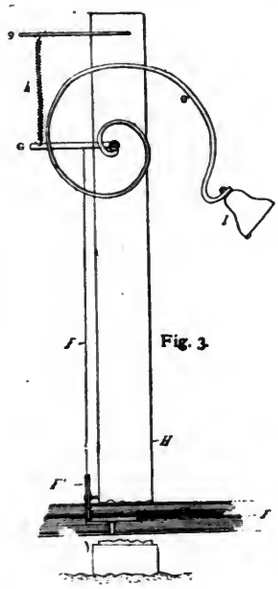


Fig. 3.

MOTT'S RAILWAY-SIGNAL.

The spring D, is made curved or bow-shaped, and the spring lies below the side-bars, to automatically return the side-bars to their proper position with relation to the rail, so that they will be acted on by the wheels of a passing train. The ends of the spring D, are connected to suitable supports *d'*, and at or near its middle the spring has a link d^2, the free end of which link is pivotally connected to an arm *e*, of a rock-shaft E, that extends under the rail of the track. The opposite end of the rock-shaft is provided with an upright arm *e'*, that has an inwardly-extending lug e^2, located just below the head of the rail, said shaft being journaled in proper bearings suitably held in place.

A transmitting-wire F, is connected to the outer end of the arm e^2, and this wire extends along beneath and is protected by the head of said rail, and the wire is supported in staples or eyes *f*, that are secured in any suitable manner to the rail.

The wire F, leads to and passes around two pulley-wheels F', placed at right angles to each other, and pivoted to the lower end of an upright post H, that supports the bell I, as shown in Fig. 3. That portion of the wire F, playing around the pulley-wheels may preferably be replaced with a corresponding length of chain as being more flexible. The wire F, is continued, and carried up from the base of said post H, and attached to an arm G, which arm is piv-

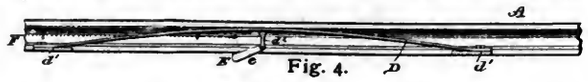


Fig. 4.

MOTT'S RAILWAY-SIGNAL.

otally connected to a coil spring G', having at its extremity the alarm-bell I. The arm G, is at its outer end connected with the upper fixed arm *g*, by a spiral retracting-spring *h*, having the desired effect of returning the bell apparatus to its normal position after the passing of a train.

It will be seen that when a train passes over a track which has the improved signaling apparatus applied thereto the wheels will depress the bars C. and spring D, thus causing the rock-shaft to oscillate, each wheel of the train successively and rapidly imparting a sharp and sudden

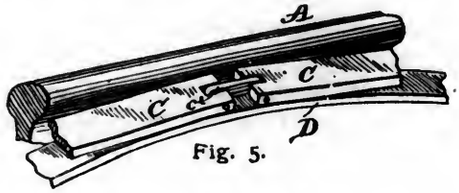


Fig. 5.

MOTT'S RAILWAY-SIGNAL.

tension or pull to the wire F, with the obvious effect of giving a rapid motion to the bell I, thus ringing the alarm. From the nature of the coil-spring G', the bell will retain its motion for some period after the passage of the train over the spring D, thus giving the desirable feature of continuing the alarm even after the rail mechanism and the connecting-wire F, have ceased moving.

In the modification shown in Fig. 4 of the drawings it is proposed to dispense with the longitudinal bars C, and employ two or a single spring-bar D, to be acted on by the car-wheel flanges to rock the shaft E, and sound the alarm; but it is preferable to employ the bars C, and

spring D, as it has been found by experiment that the latter devices give better results, are cheaper, and more durable.

It is not necessary to limit the device to the exact construction shown and described, as changes therein may be made without departing from the principle thereof.

Fig. 6.

MOTT'S RAILWAY-SIGNAL.

It is claimed for this invention that it is simple in construction, durable and economical; while it works with absolute certainty, and forms a reliable and perfect railway alarm-signal. The patent is under the control of the inventor, to whom all communications should be addressed.

A Colossal Railway Station in North London.

THE Midland Railway Company, which, within the last few years, have absorbed more than one parish in North London in the construction of their metropolitan terminal stations and other works, are now engaged in the construction of a gigantic merchandise depot at St. Pancras, which, it is stated, will be the largest and the most costly railway goods station in the world. Some twenty years since the company obtained possession of a portion of the locality known as Somers Town, for it was on the occasion of their construction of their extension between Bedford and London, about the year 1867, that they purchased the land and buildings upon which their St. Pancras Station and hotel now stand, and, it is stated, as showing the historical character of the locality, that during the excavations for the station buildings several relics, including coins of the time of Edward II and other reigns, were discovered. About the same time a large portion of Agar Town was also absorbed, and a numerous population swept away, during the erection of the company's Camden Town Station. These works have been followed by the erection of the great undertaking now in progress, for which, in the year 1877, the company obtained an Act of Parliament for the purchase of the land and buildings extending between the company's present station and Ossulston street, in the Euston road, and stretching northwards to Phœnix street, covering an area of between 14 and 15 acres. This purchase included all the proprietary rights of Earl Somers, and involved the demolition of several hundreds of houses and business premises, and the forced exodus of a population estimated at upwards of 4,000. It is worthy of notice that, from antiquarian records and maps of the period still in existence, it appears that about the end of the last century the locality was a suburban pleasure resort, on which stood the ancient Brill Tavern and surrounding taverns, and that the site on which the depot is now being constructed was known as "Cæsar's Camp, called the Brill at St. Pancras."—*Railway and Tramway Express.*

THE office of Mr. M. N. Forney, Secretary of the Master Car-Builder's Association, has been removed from No. 73 Broadway to 23 Murray street, New York, to which address communications to him should in future be directed.

American Railroad Journal.

WHOLE NO. 2,581.] NEW YORK, OCTOBER, 1886. [VOLUME LX.—NO. 7.

BEAUTY IN UNLIKELY PLACES.

PRETTY RAILWAY-STATIONS.

(*From Cassell's Family Magazine.*)

SIGNAL-BOX, LANSDOWN STATION, NEAR CHELTENHAM.

"THERE never was more flagrant nor impertinent folly than the smallest portion of ornament in anything concerned with railways or near them." Such is the explicit conviction of that arch-enemy of steam, Mr. John Ruskin.

The Brantwood philosopher, in his fervently illuminated "Seven Lamps of Architecture," decries the decoration of railway-stations as one of the most strange and evil tendencies of the present day. He conscientiously contends that if there be any place in the world in which people are deprived of the disposition necessary to the contemplation of beauty, it is there. Mr. Ruskin says that he would as soon "put rings on the fingers of a smith at his anvil," as make a railway-station pleasing to the eye. The railway-station, by the way, may be compared to the home of the smith—would he deny him Longfellow's "spreading chestnut-tree"? "It is," he continues, "the very temple of discomfort, and the only charity that the builder can extend to us is to show us, plainly as may be, how soonest to escape from it. . . . The whole system of railway traveling is addressed to people who, being in a hurry, are, therefore, for the time being, miserable. . . . The railroad is in all its relations a matter of earnest business, to be got through as soon as possible. It transmutes a man from a traveler into a living parcel. For the time he has parted with the nobler characteristics of humanity for the sake of a planetary power of locomotion."

After these vehement remarks it would, perhaps, be idle to reason with Professor Ruskin. He can find no romance on the railroad. The carriage windows of the train that conveys him from London to Coniston frame no pictures that come and go with ever-changing flight, relieved from monotony by comparison and kaleidoscopic contrast. Even the gigantic engineering works that excite the average mind by their sublime domination over the forces of nature; the lofty bridges where the traveler is

"Borne, like Loretto's chapel, through the air;"

the romance of river and rock made more ravishing by engineering realism; the graceful viaducts whose curving arches span, rainbow-like, deep and devious valleys, with wood and water far away below, and which are quite as engaging as the ruined Italian viaducts that Turner idealized—convey no more intelligent expression than that of groveling commercial greed to the supersensitive soul of the author of "Modern Painters." I quite agree with my friend, Mr. M. J. Baddeley, in his protest in this connection. He says: "Railways, in regard to their effect on natural scenery, have been abused wholesale. Poets have led the way, and everybody with a 'soul for the beautiful' has followed. They are straight and square, and altogether out of harmony with the flowing lines of nature; yet Turner's pictures abound in straight or square palaces, and level-topped bridges in the mid-distance. The churches of a rugged region, says the canon of taste, should have square towers, and not tapering spires. Why, then, should the regular lines of a railway be regarded as fatal to the natural beauty of the country through which it passes, or the express locomotive, stronger than Samson, swift and smooth as the swallow in its flight, be æsthetically regarded as a 'shrieking monster'? . . . To a great extent railways are bound to accommodate themselves to nature. They traverse a picturesque country in a succession of graceful curves, with here and there a lofty viaduct, and to the credit of our railway potentates be it said, they have shown more regard for the claims of nature, while encroaching on her domains, than any other class of men engaged in mercantile enterprise. No unprejudiced man can assert that the pass of Killiecrankie has been spoilt by the Highland railway, or that the beautiful valleys of North Yorkshire have suffered from the splendid viaducts by which the Settle & Carlisle line spans them. If there be any genuineness in the outcry against railways, it is the genuineness of a selfish, niggardly spirit, which wishes to shut out the beauty-spots of the earth from ninety-nine hundredths of its inhabitants."

This is a long quotation, but it is to the point. The railway is not the contemptible and prosaic affair that Mr. Ruskin would have us believe it to be. There is poetry in railways. Let no one, pleads Goethe, say that reality lacks poetical interest. There is sentiment in steam.

"Is this the power that has transformed the world?
This fainting thing the tenderest glassy blade
Can pierce, torn by each bramble in the glade;
Or, as it floats in thinnest wreaths uncurled,
Caught in the little ashen palms empearled,
That chafe and fret it in their babbling shade
To nothing; this that is and is not, swayed
Lighter than thistle-down by light airs whirled;
A momentary breath that scarce in May
The bedded gold can tarnish by the brook;
That yet bound in by strong necessities,
Nor at its wayward will left free to stray,
The earth beneath its flying thunder shook,
And poured behind it streaming vales and skies."

Then there is certainly something more bracing in the swift, straightforward, energizing action of the rapid express than there was in the lumbering, jerking, and jolting progress of the old stage-coach with its benumbed and petulant passengers, its heavy charges, and the dangerous vicissitudes of the road that caused the traveler to make his will before he started from London to Exeter, or Carlisle to York.

Slow trains even have their compensations, especially when they traverse a picturesque country, such—for example—as the hop-fields of Kent, or run through the pleasant Devonshire district, or skirt the Llandudno coast, or follow the Dove from Uttoxeter to Ashbourne, or the Eden from Kirkby Stephen and Appleby to the sea—the railway following the river course where the channel is belted with broad green spaces of lush meadow and flanked with picturesque heights.

The train pauses at wayside stations that are pastoral poems and pictures of happy indolence—"the negation of work in its greatest energy." The booking office and waiting rooms are embowered in flowers. Trim and fragrant hedges serve for fences. The guard stops to gossip with the station-master. Fresh-faced farmer-folk idle about the platform. The driver is evidently waiting for the squire's carriage that is being driven over the bridge, with two pretty girls, a large trunk, and a collie dog. The fast train flashes by these idyllic country-side stations, and the scream of the engine whistle does not even waken their somnolent echoes; but the town-tired traveler catches "hurrygraphs" of them sufficiently tempting for him to wish that the "limited mail" were a city omnibus, so that he could order it to stop just where he pleased.

But it is of pretty railway stations that I am bidden to discourse. Mr. Ruskin and his school would, perhaps, deny the possibility of such utilitarian institutions existing in artistic shape, despite the convincing evidence afforded by the grand Gothic pile at St. Pancras, one of the noblest architectural ornaments of the metropolis, whose booking-hall, by the genius of Sir Gilbert Scott, has a cathedral-like appearance. A vivacious American writer (Mr. N. P. Willis), speaking of the railway palaces of England, says that when London shall have become the Rome or Athens of a fallen empire, the termini of the railways will be amongst its finest ruins. The arches, gateways, and pillars of Euston remind him of "that flower of sumptuousness, the Royal Palace of Caserta, near Naples." Mr. Willis wrote his diverting "Loiterings of Travel" forty years or more ago, and the termini of the great railways have grown more impressive since the days when he sketched our scenery and society. To the modern American tourist, however, nothing is more pleasing than traveling by train through the English counties. The railway route seems to be a ribbon of gleaming steel wandering through a prolonged garden of green mixed up with old-world villages, ivied manor-houses, ancient churches, and russet farmsteads. The wayside stations, with their healthy country life, trellised with flowers, and half-smothered with trees, the gentle civilities on the platforms, the milk-cans and barrows laden with the produce of field and garden, present to him so many fleeting pictures to be recalled when far away from their surroundings.

ALTON TOWERS (NORTH STAFFORDSHIRE RAILWAY).

Pretty railway-stations! I mind me of Matlock Bath, with its châlet-like appearance among Swiss-like surroundings—the Willersley cutting behind you to the south, in summer the walls of the ravine a grotto of ferns, in winter an alley of icicles hanging, apparently, from the sky, in pendants of crystal and diamond; the Masson heights to the left; lime-stone "scars" to the right; in front the tunnel burrowing its way under the majestic High Tor, like a pin-point perforating a huge sheet of gray paper.

I think of the picturesque station at Furness mixed up with the ruins of the grand old abbey, uniting the Victorian Era with the monastic life of the Middle Ages. I recall the quaint little station at Alton Towers, with its rose-garden and tree-shaded nooks, in the romantic Churnet Valley, a station that supplies the artist with a picture at every point, whether from bridge or platform, riverside or adjoining heights. I try to remember the names of some delightful Yorkshire stations which have no ambition to be thought æsthetic, or "early English before it is too late," but are, nothwithstanding, most charming revelations in the swift landscape of the line. I have most agreeable recollections of the stations between Oban and Callander (Professor Blackie out of the question!), the châlet-like stations at Loch Awe, and other calling places on the Oban line, such as Ach-na-Cloich, Connel Ferry and Dalmally—not to forget Oban station itself, with its wonder of nasturtiums climbing pillar and girder, and hanging ferns under a cheerful expanse of glass, that suggests a conservatory rather than a railway terminus.

I know of one or two tunnels that are externally positively picturesque. Travelers from the north to London, *via* Trent, must have noticed when entering Redhill tunnel the wealth of woodland at the portals, with gray baronial battlements at either side, and the telegraph masts with their web of wires carried far away up among the trees. Pointsmen's boxes even can, with their "levers" and "repeaters," and tinkling bells, eloquent of the "block system" of signaling, be made "things of beauty," if not "a joy forever." How many passengers each summer, for instance, admire the handsome station signal-box at Cheltenham? It is during the summer months a perfect "basket of flowers," and more resembles a radiant greenhouse than a prosaic receptacle for "switches" and "three-throws." Creeping plants climb up the sides of this cabin. Ornamental baskets are suspended from the eaves, from which droop festoons of flowers. The signalmen look out of windows bright with fuchsias and geraniums. Wire-stands filled with flowers are placed on either side the box, while behind is a fernery, where bright flowering plants mingle their colors with the cool grays and greens. Wild birds build in the station-roof, and become almost tame despite the rush and roar of the passing trains with their vibration and smoke.

On the lines of the West of England, pretty railway-stations are numerous. In the opening summer time, when the orchards of the beloved Western country are in flower, the stations appear to nestle amid the red and white blossoms of apple and pear trees. I do not intend to convey that these stations are models of ornate architecture. Railway shareholders, eager for their dividends, would scarcely approve of that. But still, there are quaint designs of gable, delicate suggestions of pretty windows,

FURNESS ABBEY STATION (FURNESS RAILWAY).

and artistic points about many of these wayside stations, picturesque enough for all painting purposes.

The cultivation of flowers is a pleasing characteristic of English railway-stations. There are some stations—such as Dumfries, on the Glasgow & Southwestern main line, and Didsbury, on the Manchester South District—that owe their prodigal show of shrubs and flowers on the platforms to the professional nurserymen displaying his horticulture as an advertisement. It is not to these elaborate instances that allusion is here made so much as to the country-side stations, where the station-master and his man and lad spend their spare time, from the booking office and the lamp-room, in beautifying their platforms with borderings, and plants, and flowers.

And how charming is the result of their recreative efforts to travelers in passing trains—what visions of beauty alternate between bridge, and tunnel, and cutting—what pleasant glimpses of color! "The speech of flowers excels all flowers of speech," and it is heard above the

screech of the engine-whistle and the noisy rattle of wheels.

Railway directors, supposed by most people to be the most case-hardened of men, are even guilty of cherishing this taste for floral cultivation among the workers on the line. They not only give their employés garden allotments to cultivate peas and beans, cabbages and potatoes, fruits and flowers, but one board of directors (that of the Midland Railway) votes an annual sum of £100 to be distributed in prizes over the line for the most neatly-kept platform gardens at the passenger stations. Last year (1885) as many as seventy-six stations competed, and the prizes were graduated from £10 to 5s. The result was very gratifying.

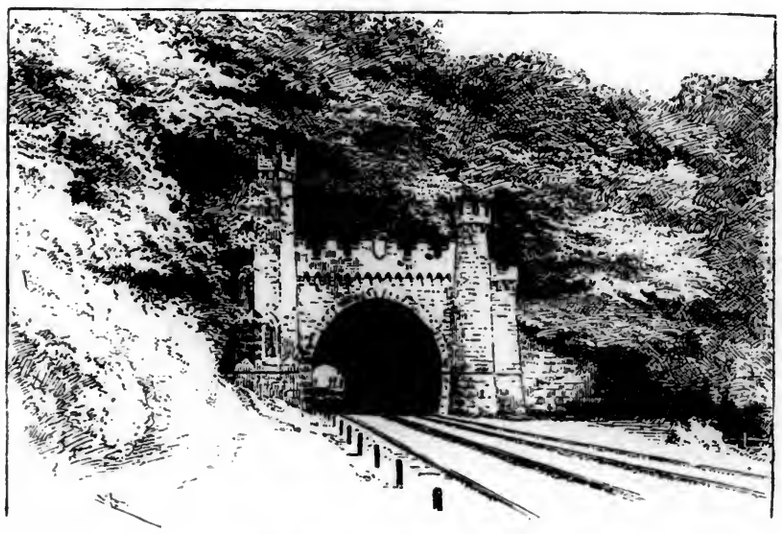
Even stations such as Armley, at Leeds, and Brightside, at Sheffield, which are enveloped in foundry smoke and vitriolic vapors, despite their antagonistic surroundings, succeeded in producing pretty floral effects. At other stations, where the vegetation was in a less degree liable to be parched on the railway slopes, and suffered in a minor degree from engine sparks and "smuts," the effect of the efforts put forth was most encouraging. At Kinnersley, a station on the South Wales section, clay banks were converted into terraces of flowers, and "the desert was made to smile." At Bakewell, banks, before rough and unsightly, were planted with carpet-like turf, and diversified with flower designs and devices in shining Derbyshire spar. In the spring, they were gay with tulips and hyacinths. People came from a distance to see them. In the summer, bedding-plants were substituted; while rustic baskets with ferns and trailing flora were suspended from the roof of each platform.

It is eminently satisfactory to learn that at the stations where the borders are kept the best, the public have most assisted in preserving the plants. Where the flowers have been most profuse, the customers of the line have been their most zealous custodians. The much maligned "cheap tripper" has refrained from plucking them; and even on thronged excursion platforms, during the busy summer months, not a single bloom has been missed This encouragement gives hope of even better results in future years.

Of course, there are ugly railway-stations that admirably answer all Mr. Ruskin's requirements of uncomeliness. Even those at "show places" are not in the best of taste. That at Stratford-on-Avon is the apotheosis of the common place. It seems to act as a foil upon the old-world charm of the classic streets of Shakespeare's town. But, as Mr. Ruskin *might* possibly urge, with his sweeping method of generalization, if you make Stratford station a half-timbered edifice with quaint gables, the traveler will only care less for the house in which Shakespeare was born; and if you plant the platform with old-fashioned flowers, he will only have less pleasure in the green and bowery wilderness surrounding Anne Hathaway's cottage at Shottery. Still, the world cannot be made too beautiful; but while appreciating the beautiful we must not forget the practical. Even Mr. Ruskin's ardent arguments are not strong enough to make a "permanent way"; and his most fervid utterances are not sufficient to drive the Scotch express; although he may, with Tennyson, find—

> "—— enjoyment more than in this march of mind,
> In the steamship, in the railway, in the thoughts that shake mankind."

EDWARD BRADBURY.



RED HILL TUNNEL, TRENT.

MODERN VIEWS CONCERNING APPLICATIONS OF FLAME TO HEATING PURPOSES.

BY PROF. OLIVER J. LODGE, D.SC.

THERE is little doubt but that the experience of many engineers and manufacturers is hostile to the complete combustion of fuel—technically called the consumption of smoke—regarded from the point of view of economy. In boiler fires it is continually found that as smoke is consumed, so is the output of steam decreased; and, so long as this is the case, it is hopeless to expect the non-emission of smoke from boiler fires, except under very severe penalties, which the community would be loth to exact. In high temperature furnaces, experience of smoke consumption is far less discouraging, and there are not wanting manufacturers to assert, on apparently good grounds, that they effect some 40 or 50 per cent. economy

in coal now that they adopt a more perfect system of firing.

At first sight, economy of fuel would appear to be a necessary result of an enlightened design of furnace, and of perfect combustion; and if in certain cases this result does not follow, but rather the contrary, there must be a reason, which it behooves one to discover. In the light of the researches of Mr. Frederick Siemens, the views of Professor Armstrong, and some recent experiments by Mr. Fletcher, the reason is not far too seek.

The first and obvious ideas on the subject were somewhat as follows: Smoke combustion has been attained by the admission of an extra supply of air at a certain point of the flame, so that none of the gas formed may distil over unburnt, but that all may meet with a due supply of fresh air, unsophisticated by passage through red-hot coke, and thereby deprived of its active element. It is plainly desirable to admit no more air than is necessary, especially when one considers that every cubic foot of oxygen brings with it four or five cubic feet of inert nitrogen, which has to be raised to flame temperature, and which acts simply as a cold diluent. Hence attempts are often made to proportion the supply of air to the supply of fuel, and to allow for the rapid evolution of gas which goes on directly fresh coal is injected. This can be done in two main ways—firstly, by making the extra air-supply intermittent in quantity, to suit the intermittences of stoking, extra air being admitted every time a fresh shovelful is thrown in, and for some time afterwards, as in Prideaux furnace doors; secondly, by letting the air-supply be steady, but making the fuel-supply steady also, as with automatic stokers. It is also plainly desirable to supply this fresh air not cold, but hot; and the waste heat of the furnace is, in the best arrangements, utilized to effect this.

This being all well known, I say the first and obvious idea as to the cause of the diminution of steam supply when a smoke-consuming arrangement is introduced, is that either too much air has been introduced, or that it has been introduced cold. Either of these causes will certainly assist to produce the effect; but, considering that, however carefully they be avoided, no great economy of fuel results—at least in boilers—and considering that, unless air is so introduced, immense quantities of gas and combustible matter escape unconsumed, it is pretty plain that the cause of the paradoxical wastefulness of perfect combustion must be another and more deep-seated.

Consider, therefore, the two classes of flame; one in which combustion is imperfect, the other where it is thorough and complete—for example, say a paraffine lamp without a chimney, and the Bunsen lamp of a laboratory. The one is luminous and smoky, its radiating or toast-making power is great; but it is unable to heat bodies put into it much, because it coats them so thickly with soot. The other is clear and non-luminous, its radiating power is extremely small, but it is supposed to heat bodies put into it very well; certainly it does so better than the other. But does it, after all, heat bodies put into it so perfectly? The answer, after consideration, must be: If they are such as can become white hot, yes; if they are such as remain comparatively cool, no. A piece of thin wire, or ash, or dust, is well and perfectly heated; a cold soldering or flat iron, or a kettle, is slowly and very imperfectly heated. And why? For two reasons—firstly, because it interferes with combustion. For combustion a certain temperature is necessary. Heat mixed oxygen and hydrogen to any temperature short of this, and they hardly combine at all; if they do, it must be a very slow process. Heat them up to the right temperature, and they burn at once. Now, a kettle of water introduced into a flame instantly cools a great part of it below the igniting point, and the gas burns in a very imperfect manner, as is evidenced by the irritating smell of acetylene. That is one reason, but that is not the whole; perhaps it is not the main reason. The second reason is, that *the flame never really touches the body it has to heat.* How can it? The body is at nothing like the temperature of flame, and accordingly no flame can exist in contact with it. Combustion is not only imperfect, it actually ceases within a short distance of the surface. A layer of dark, non-conducting air or gas, at some quite moderate temperature, intervenes between flame and kettle; and across this film heat can only pass by radiation. No non-conductor is so perfect as air or gases. In so far as the film is warm, it may indeed impart some heat to the surface, but little; the great part of the heat has to be transmitted through the film by radiation from the main body of the flame. *But then this non-luminous flame is a shockingly bad radiator*, and so very little heat really reaches the surface at all. What, then, is the remedy? There are two. Either the surface to be heated must be allowed to get red or white hot, and so permit the actual contact of flame without interfering with combustion, and without interposing a non-conducting, dark, gaseous layer; or else non-luminous flames must be abolished, and highly radiating ones used instead. The former is Mr. Fletcher's plan, the second is Mr. Frederick Siemens'.

If the bottom of a copper kettle, instead of being $\frac{1}{16}$ in. thick, is, say, 3 in., or perhaps more, there is some chance that the outer skin of it may be raised to a white heat by a perfect "solid flame" burner placed underneath it. In this case combustion will not be interfered with, and a torrent of heat will pass through the copper into the water, the gradient being some 1,000 or more degrees per 3 in. Thus we arrive at the paradox that a thick-bottomed kettle may boil water quicker than a thin one. This is not, indeed, Mr. Fletcher's way of putting the matter, nor is it his plan. He proposes a multitude of studs, or ribs, to project from the bottom of the kettle, or inside of the fire-box, into the flame, to receive its heat without unduly chilling it. It seems to me that the thick slab is simpler, and likely to be more effective.

The other plan, that of Siemens', is to avoid flame contact altogether, to use a highly luminous and regenerated flame, and to work solely by radiation. This seems to me the better plan on the whole, especially as it avoids burning of surfaces.

Admitting that flame cannot really touch the ordinary surfaces which it has to heat, don't try to make it touch. Admitting that the heat of a flame must reach such surfaces ultimately by radiation, increase the radiating power of your flames as much as you can, so as to get the greatest possible advantage from them. This is probably the future method of applying combustion heat in all industries. Rich gas supplied with intensely hot air, and burning at an excessively high temperature in free space.

Returning now to the consideration of ordinary smoke consumers, the reason of their lack of economy is, I think, manifest. Without such arrangements the flame is smoky indeed, but luminous; it contains plenty of solid matter, and, therefore, has considerable radiating power. Its temperature is, indeed, not very high, nor is the combustion at all perfect; but still, as it passes along the flue, it can send out a lot of heat to the surfaces; and even when the flame has ceased, the hot carbon particles continue their journey, and radiate as they go.

But admit sufficient air-supply to render the combustion perfect, and note the change. A non-luminous, or only partially luminous flame, almost free from solid matter, now passes along the flues, and radiates to them very little. True, cross tubes are inserted for it to play against; but, as we have seen, it cannot really touch them, it must do its heating ultimately by radiation, and it accordingly is unable to accomplish very much. It is not, indeed, necessary, or advisable, or customary in practice to admit air enough to render the flame really blue and non-luminous. I have only put an extreme case.

We may sum up the two cases thus—with smoke: Great escape of unburnt matter, both gaseous and solid, and low-temperature flame, but good radiating power and large percentage of heat really given to the boiler. Without smoke: More or less complete combustion and hotter flame, but poor radiating power, and smaller percentage of heat produced really utilized. Though, as more heat is produced in this case than in the former, the actual heat utilized may be much the same in both. With some arrangements one plan gives an advantage; with others, the other.

Evidently, to high-temperature furnaces, where no cold surface need come near the flame, these considerations scarcely apply, and complete smokeless combustion can then hardly fail to be much more economical than incomplete. Though, indeed, Mr. Siemens thinks that all solid contact interferes with a flame—inducing dissociation—and he accordingly endeavors to keep flames from contact even with white hot surfaces, and to work solely by radiation.

This seems to me the direction to look for perfection: To increase the temperature of a flame by regeneration; to increase its burning or radiating power by a sufficient supply of solid matter; to keep it out of contact with a solid surface, making it play down the center of flues, or causing it to form a sheet under and around a kettle; and to adjust the air supply so that combustion is quite perfect, and no unburnt or semi-burnt gas or solid matter escapes to cause noxious smells, and to foul the atmosphere.—*Industries.*

ENGLISH AND AMERICAN LOCOMOTIVES.

No. 1.

WE purpose shortly illustrating an American passenger locomotive, for the purpose of familiarizing our readers with the type of engine which has grown up in America under the peculiar conditions of that continent.

No doubt these illustrations and dimensions will be of interest to our readers at the present time, when so much is being written on the various merits of English and American engines. Though some of those who join in the discussion do so evidently in an engineering spirit, there are others who appear solely to utilize the opportunity as a means of venting a little spleen, as a kind of sop to perhaps their official disappointments or professional non-success. The question to our mind is a purely mechanical one, and, as such, requires a purely mechanical treatment. In the first place, what is the main point in which American locomotives depart from the English type, or more correctly, in what feature has English locomotive practice departed from the earlier features which formed the basis of the practice of both England and America? Clearly, the framing is this feature. Early English engines had the bar frame, and it is but quite recently that some old engines of Bury's make were to be seen at work on the Lancashire & Yorkshire Railway. They had only four wheels, all coupled, bar frames, and huge copper-covered fire-box casings. From this original type English practice has departed, and we now have thin but deep frames of plate, which admit of the widest possible fire-box between the frames. American practice adheres to the bar frame, though it is sometimes modified by flattening alongside the fire-box, and in the Wootten engine the fire-box is made to extend over and beyond the frames.

For years past the track of pretty well every English railway has been so good that engines have been built to suit such first-rate track, and such engines as a consequence are scarcely suited to run on a bad road. Many—most American tracks are very far from first-class, and though many hundred miles of track in the States are perhaps as good as any track in England, there are still thousands of miles very inferior. This cannot but be otherwise when it is considered that the line is often laid unballasted over the almost natural surface of the ground. On this account, therefore, the design of American engines has developed accordingly, and they are so constructed as to be capable of safely traversing a track which would derail an English engine. Such a design, however, does not prevent the engine from running well over a good road, and American engines have developed speeds as high as any other build. As a piece of machinery there is much about an American engine which will appear rough and ill-finished to the eye of an English workman. By this, we do not mean ill made, but the finish is rather rough and does not compare with that of English first-rate work.

There is a superfluity of molding about the dome and sand-box which hardly adds to good appearance. This will be shown in our illustrations. The wheels of even an American express engine are of cast-iron. This only proves the excellent quality of American cast-iron, and, as a detail of construction, is one which is bound to give way, as is also the English forged-iron wheel, before many years, to the wheel of cast-steel, such as may now be seen at the Liverpool Exhibition. Cast-steel will prove superior to both of the other materials and far cheaper than forged iron.

Several other details of construction are weak in appearance, but we are assured by an English engineer, to whom we referred the matter, and who has had 13 years' experience on American railways, that such is not the case. There is one point upon which we must touch, in justice

to American builders; we refer to the exceedingly free running qualities of their machines. Other things being equal, the American locomotive is freer running than is the English. This we can only attribute to the greater freedom of various parts, the free use of compensating beams, the absolute horizontality of the outside cylinders reducing rocking to a minimum, and to the arrangement of the valve mechanism. Our personal experience, and the testimony of a goodly number of drivers who have been accustomed to handle both types of engines, is in favor of this statement.

A point aimed at by American designers is evidently accessibility of parts, and, we think, no one will quarrel with us when we state that the very opposite effect has been attained by the designers of inside cylinder engines, with valves between the cylinders. Nothing could well be worse than this. At the same time, with all the conveniences to be found on a modern railway, the awkwardness is much diminished. Such a construction would, however, be quite inadmissible on an engine which might require repair 500 miles from anywhere.

To what conclusion are we forced by all these considerations, backed up as they are by the fact that England supplies no engines to Canada, for example? We cannot for a moment admit that we are unable to compete, for such an idea is absurd on the face of it. England can compete successfully with any other nation, if she cares to do so, and if English locomotive builders would do so they could produce locomotives having all the accessibility of parts seen in the American engine; they could use cast-steel wheels, produced as cheaply as the cast-iron wheel of America; they could make their fire-boxes of steel, for it is sheer nonsense to say we have no steel suitable for boilers, and nothing but ignorance could support such a statement in the face of the testimony of all the best boiler-makers of the country. As regards the bar frame, this is too simple to require comment. If called for, let it be made. Quite apart from the question of whether one engine is better or worse than another, our constructive engineers would be wise if they laid themselves out to supply a demand, not to force a sale.

New countries require many articles which differ from the articles required for similar purposes in older countries. America, as a new country, has made locomotives to suit its peculiar requirements, and thus we find her supplying other new countries to a very large extent. Probably, if tried on some of the older lines in America, such as the Philadelphia & Reading, one of Mr. Stirling's outside-cylinder 8-feet engines would give immense satistion to both the road officials and the passengers; but, if this engine were run towards the west, it would tone down gradually in estimation as the roads became more uneven.

As a rule, all constructive engineers are very conservative in their ideas. They get into a groove, and once in it nothing lifts them out. "Do you think we can sacrifice all those patterns?" say they; "why, my grandfather helped to make them when he was apprentice!" and so on.

We have personally known firms of a high reputation refuse to make little alterations in their engines, which they have been requested to make by their own agents—for climatic reasons, too. No; this part runs well at home, why not then with you; with you being perhaps 20° nearer the equator. All this may seem trivial; it is, however, very important. We have repeatedly called attention to such facts, as a matter of duty. We have heard hard swears in warm climates at many a close fit in detail which should have been a free fit; and we have seen men who have occupied good positions, where they might have learned something if they would, leave a colony as pig-headed as when they entered it; and trade keeps slipping away from us, who are better fixed for carrying it on than any other nation, and all because of our willful blindness. The American tariff is a proof that we cannot be touched in fair competition, and we go on handicapping ourselves by using copper for fire-boxes when steel would suffice, brass for tubes which are received from America in iron, and so on. We do not uphold work when cheapened by bad execution, but when cheapened by the known substitution of a cheap for a dearer—and to some minds an inferior—material, we can see no objection to it, so long as it is sold for what it is. An American engine is said by one writer to be £400 cheaper in material, etc., than an English engine, and though we cannot endorse this writer's figures, as he has scarcely the experience upon which to form reliable opinions, the statement is substantially in the right direction. Now £400, or half of this sum, is a big discount from the present cost of a locomotive, and well worth attention. We therefore maintain that the question of English versus American locomotives is not whether either is better than the other, each in its own peculiar conditions, but which type is called for by our customers abroad, why or from what special qualification the call arises, and how it can be best responded to in England.

How Englishmen See Us.

IN a paper recently read before the Cleveland Institution of Civil Engineers (in England) on "An Outline History of the Locomotive Engine," by Mr. Theodore West, the author digresses from his subject to comment on American words and ways. The following are some of his remarks:

AMERICAN TERMS.

We were amused with the names familiarly applied to engines, according to their use. Thus, an engine to assist a train behind, up an incline, is termed a pusher; a midnight train is called an owl train, and an extra or express-goods is called a wild-cat or fast-freight train, because it has to look out for itself all the way, being outside the regular time trains. The difference between American and English railway names all through is amusing. A railway is always a railroad, a station a depot, carriages are cars, a chimney is a smoke-stack, guards are conductors, goods they term freight, luggage is baggage, a ticket for luggage is a baggage-check, and incline is an up-grade or down-grade; forming or leveling a road is grading it. Where we might say the fast express they call it the lightning express, just as they speak of lightning stove polish, the lightning clothes washer, and lightning apple and potato parers, and many others. Where the English guard would say, "Take your seats, gentlemen," or "Take your seats, please," according to class, the American

conductor cries out, "All aboard!" and where an official here might say to a late passenger, "Make haste, if you please," his Yankee brother would call out, "Come! hurry up!"

BAGGAGE CHECKS.

In the long, dusty journeys incident to American travel, the filter of iced-water for drinking, mostly provided in each car, and the retiring convenience parted off at the rear end, are most sensible and praiseworthy; as are some other features in their refreshment systems, the forwarding luggage by the express agencies, and the sale of tickets by various town agents at any time you wish to procure them. We do not, however, consider the baggage agency quite so perfect as they usually boast it to be, and as we found it to our cost in traveling there, and trying at two or three stations in succession to dispose of a heavy package. This had got uncomfortably loaded with fossils, minerals, and other curiosities given to us or picked up en route, and as we were going from Philadelphia to pay a flying visit to Niagara, and were pinched for time, we concluded to sort a few needful articles of dress on our way, then fasten up the bulky package and leave it at the first stopping station that allowed time, to be sent on to the shipping office at New York, just as we could have done from any English station. At one station after another, however, as we risked losing our train to try, we were invariably met with the question "Where's your baggage check?" and without this ticket (which we each time offered to pay for) on no account would they take it. First, this game at sixes and sevens was absurd and amusing, but soon grew tiresome and aggravating; particularly as one had so often heard the self-complacent boast about their perfect system of forwarding baggage. No explanation or offer to pay would induce them to touch our burden, nor condescend to explain where our default lay, until it dawned by degrees, first, that said baggage agency is generally a speculation separate from the railway company; second, with town offices, often away from the railroad station; and third, that unless you forward your baggage from the starting point independently of the railway company, you will on no account be permitted to do so en route. However, in despair, we determined to manage it; and, having a little more time at a large junction, we tried it, and being once more refused, we spied just outside the station a baggage office and a Lightning Express Company's baggage-van being loaded by a decent looking Irishman; so, coolly placing our package inside his van, he, astonished and protesting, once more demanded our baggage-check. We told him that was just the thing we were wanting and had been trying to get all day. He replied that we could get one in there, pointing to the office we had just come out of. "No!" we answered, "we had just come out of there, and the clerk was daft and couldn't understand us;" so, putting a half dollar into his hand, we told him he must take our bag, check or no check, to the depot, and set it off to New York with the rest; it was all right, and our train was just going. We left him growling and wondering wherever we had landed from, or what we could be that dared to take such an audacious liberty in that "land of freedom." At imminent risk we dived back through the crowded station, under trains coming and going, and happily rejoined our own just in time. We went on our way rejoicing, and, in due course, found our baggage in the White Star office in New York; but it was a risk despatching it as we did, and we found by that and other experiences, that the cost of this freedom from care of luggage forms a serious addition to traveling expenses, and is wanting in elasticity or adaptation to circumstances. Whilst the Lightning Express baggage system is a boon to the wealthy and well-to-do, it certainly lightens the traveler's purse, and leads us to consider our own system, whatever its drawbacks, by no means so despicable as Americans make out. On either side the Atlantic the "highfalutin spread eagle" kind of brag of an out-an-out Yankee, fully matched by the haughty self-conceit and consummate assurance of a thorough-going "Britisher," should be tempered by mutual respect and good-will, and the sweet reasonableness of common sense and fairness.

Estrade's Locomotive.

MR. A. FICTET, in a letter to the *English Mechanic*, says: "This new locomotive with driving-wheels (in fact, all wheels) of 8 ft. 3 in. diameter, is now complete, and is on view at the shops of M. J. Boulet & Co., Paris. Whether the designer's ideas of high speed will be realized may be doubted, but the following description will interest many of your readers.

"It is impossible not to be struck by the character of grandeur and power of this beautiful engine, with its six driving-wheels, of one diameter in common of 8¼ ft., mounted upon three coupled axles. The inventor's idea, it will be remembered, consists in generalizing the use of wheels of large diameter, in the extension to high speeds of the coupling of the axles of the motor, and in the adoption of a new and well-studied style of double suspension. The principal dimensions are as follows: Total length, 33 ft.; width between longitudinals, 4 ft.; diameter of the wheels, 8¼ ft.; weight of engine, empty, 38 tons; weight of engine, loaded, 42 tons. We shall not now return to a theoretic discussion of the qualities of this engine. M. Estrade has peremptorily answered this with faith and generosity by having built, as carefully as possible, and of true size, the one-tenth size model that he had deposited in the galleries of the Conservatoire des Arts et Métiers, and concerning which quite a number of controversies have already arisen. It is to be wished that some experiments shall soon be performed, either upon the lines of our large companies or upon those of the State. They will be deeply interesting and instructive. It does not appear doubtful that it will be possible to reach the high speeds of from 72 to 78 miles, for which this locomotive has been constructed. The equal size of the locomotive-wheels, and of those of the cars, will, doubtless, in a great measure diminish the resistances of friction, and permit of high speed. It must be noted that the fore-axle of the locomotive, although coupled with the others, is provided with hinged grease-boxes. On properly slowing up, then, it does not seem that it will be impossible to turn curves of the usual radius. This granted, we can appreciate what peculiar services will be rendered by rolling-stock of this kind in the India mail service and on the great rectilinear lines of Russia, Asia and the New World, and everywhere, in fact, where it is desirable to cross with exceeding rapidity great desert spaces between centers of population. Were it from but this standpoint, M. Es-

trade's rolling-stock would merit being taken into serious consideration; and it is very desirable that the experiment shall be performed in France, since it is a question of a French idea, all the expenses attending the carrying out of which have been liberally defrayed by one of our compatriots. These experiments will give us new hints, and will permit of passing a definite opinion very opportunely at the moment when Mr. Crampton, the eminent English engineer, improving upon the beautiful and effective engine to which he has given his name, is proposing a new model with three axles, of which two are to be coupled, and which are to carry wheels 6¾ ft. in diameter. In M. Estrade's *matériel*, the Westinghouse brake has gained a new success, since it has been selected after a study of all the devices capable of braking these high-speed trains.

"It is thus that a French paper speaks. Time will prove whether M. Estrade's engine is any better than those you have known well for years."

Cast-Glass Rails.

BERLIN papers copy from the *Germania* the account of an important discovery in glass manufacture made by Friedrich Siemens of Dresden, in which it was said that he has succeeded in casting glass in the same way as metal is cast, and obtaining an article corresponding to cast metal. This cast-glass is hard, not dearer in production than cast-iron, and has the advantage of transparency, so that all flaws can be detected before it is applied to practical use. It will be much less exposed to injury from atmospheric influences than iron. The process of production is not difficult, the chief feature being rapid cooling. The hardness and resisting power of this cast-glass are so great that experiments are being just now carried out at the Siemens Glass Foundry at Dresden with the purpose of ascertaining whether the material could be employed for rails on railways.

In a letter on the above subject to the London *Times* of September 7th, Mr. H. Lindsay Bucknall says:

"As the inventor and patentee of glass sleepers for railways, which have been manufactured for me by Mr. Friedrich Siemens, of Dresden, and never having heard of any idea on the part of Mr. Siemens or anybody else venturing to propose glass for the purpose of rails, I at once communicated with Mr. Siemens, and have just received the following explanation dated, Dresden, August 27th:

"'As concerns the report mentioned in several English papers about the discovery of producing rails in the same way as sleepers, I must state that the contents of this report are founded on a misunderstanding. German newspapers which took their articles regarding cast-glass from English journals, erroneously translated the English 'sleeper' into the German 'schienen,' signifying 'rails' in English; and it was this mistake which led the English papers to the opinion that Mr. Friedrich Siemens had succeeded in manufacturing rails also from cast-glass.'"

Mr. Bucknall says further: "Allow me to add, for public information, that a sample of these glass sleepers recently tested at the Anderston Foundry Company (Limited), Glasgow, resisted a falling weight of 3¾ cwt., falling upon a rail placed upon the sleeper set in sand ballast, commencing at 6 inches and rising by succeeding increments of 6 inches up to 9 feet 6 inches—the *maximum* elevation to which the test ram could be elevated—without effect, until the blow had been repeated for the sixth time. Cast-iron sleepers are expected to withstand a similar test up to 7 feet only.

"The cost of glass sleepers will be considerably less than that of either cast-iron or steel, while the material is practically imperishable as regards climatic changes and influences, or the ravages of such insects as the white ant."

H. LINDSAY BUCKNALL,
Assoc. Inst. C. E.
7 Westminster Chambers, S. W.

Report on Steel-Tired Wheels Removed and Running on the Boston & Albany Railroad.

THE following report upon service of steel-tired wheels on the Boston & Albany Railroad, by F. D. Adams, Master Car-Builder, is interesting through comparison of service of wheels manufactured by different companies, and further through the fact that very few railroad companies could furnish similar statistics on a subject of such economic importance:

"We had running December 31st, 1885, 1,493 33-inch Hartford steel-tired wheels, as per individual mileage report Of this number, 11 wheels are running between 400,000 and 500,000 miles; 135 between 300,000 and 400,000 miles; 458 between 200,000 and 300,000 miles; 463 between 100,000 and 200,000 miles; and 426 less than 100,000 miles.

"Of this number, 327 wheels have made between 100,000 and 150,000 miles before first turning; 75 have made between 150,000 and 200,000 miles before first turning; 46 have made between 200,000 and 300,000 miles before first turning; 3 have made between 300,000 and 400,000 miles before first turning; 12 wheels are now running between 150,000 and 200,000 miles and have never been turned; 21 wheels are now running between 200,000 and 300,000 miles and have never been turned; 1 wheel is running between 300,000 and 400,000 miles and has never been turned.

"Of the Washburn Car-Wheel Company's 33-inch steel-tired wheels, we have removed for the year, as condemned for passenger service, 102 wheels; their average mileage has been 281,672 miles. The 102 wheels averaged 112,433 miles before turning; 95 averaged 83,634 miles after first and before second turning; 82 averaged 58,901 miles after second and before third turning; 56 averaged 46,940 after third and before fourth turning; 29 averaged 40,724 miles after fourth and before fifth turning; 15 averaged 34,129 miles after fifth and before sixth turning; 6 averaged 27,597 miles after sixth turning.

"Of 33-inch Allen paper-wheels the total number in service December 31st, 1885, was 348. 177 removed for first turning averaged 69,472 miles; 62 removed for second turning averaged 42,499 miles; 24 removed for third turning averaged 39,521 miles; 8 removed for fourth turning averaged 30,471 miles; 2 removed for fifth turning averaged 39,202 miles.

"Of 42-inch English wheels the total number in service December 31st, 1885, was 220. Of these, 176 removed for first turning averaged 70,598 miles; 36 removed for second turning averaged 79,667 miles."—*Railway Equipment and Mileage Guide.*

Fast Time on the New York Central Railroad.

WE present herewith a schedule of the time made by newspaper special train No. 11, on the New York Central & Hudson River Railroad, between Syracuse and Buffalo, on August 8th, 1886. The train was drawn by engine No. 541, John W. Cool, engineer. The schedule is certainly a remarkable one and worthy of permanent record:

STATIONS.	Departure.	DISTANCE. Total.	DISTANCE. Intermediate.	Time between Stations.	Rate of speed per hour.
	Hrs. Min. Sec.	Miles and Hun'ths.	Miles and Hun'ths.	Minutes and Sec.	Miles and Hun'ths.
Syracuse	10 A. M.				
Oswego Junction	10 03 30	3	3	3 30	54 54
Warner's	10 09 30	9 34	6 34	6	63 40
Jordan	10 16 30	17 05	7 71	7	66 08
Weedsport	10 20 20	21 39	4 34	3 50	74 40
Port Byron	10 23 20	24 76	3 37	3	67 40
Savannah	10 29 35	31 76	7	6 15	68 29
Clyde	10 35	37 96	6 20	5 25	70 86
Lyons	10 41 50	45 33	7 37	6 50	68 03
Palmyra	10 52 35	57 84	12 51	10 45	71 62
Fairport	10 03	70 64	12 80	10 25	74 93
Rochester	11 12	80 74	10 09	9	67 27
Rochester *	11 20				
Coldwater	11 25 35	86 89	6 16	5 35	69 08
Bergen	11 35 15	98 44	11 55	9 40	73 72
Byron	11 41 10	106 16	7 72	6 55	70 72
Batavia †	11 50	112 76	6 60	7 50	52 72
Crittenden	12 03 30	128 52	15 77	13 30	71 14
Grimesville	12 12	138 11	9 59	8 30	69 33
Buffalo E. St.	12 24	148 70	10 59	12	52 95

* Stopped for water. † Slowed up.

Average speed Syracuse to Rochester.....per hour 67 27
" " Rochester to Buffalo..... " 63 72
" " Syracuse to Buffalo..... " 65 00

The train consisted of a baggage-car and coach. The engine had 17×24 in. cylinders; wheels, 5 ft. 6 in. diameter; fire-box, 72 in. long. The boiler had 1,353 square feet of heating surface. The valves had a maximum travel of 5 in., ⅞ in. outside lap and $\frac{1}{32}$ in. inside. The steam ports were 15½ in. × 1⅛.

Mixed Trains.

THE subjoined letter has been addressed by the British Board of Trade to the secretaries of the different railway companies:

"The attention of the Board of Trade has been specially directed by some of the reports which have recently been received from their inspecting officers to the practice of running mixed trains, in which passenger carriages have been attached to goods wagons. The facts brought to their notice in these reports have borne out the opinions expressed in previous reports as to the dangers arising from the running of mixed trains, especially when goods or other wagons are placed between the engine and the passenger carriages. The inspecting officers report that the risk of so placing the passenger carriages outweighs the advantages which may, in some cases of accident to the front of the train, have resulted from the wagons taking the worst of the shock. In these circumstances the Board of Trade wish to call the attention of the directors of the ——— Railway Company to the desirability of avoiding, as far as may be, such a practice. If the running of mixed trains is not altogether avoidable, care should be taken that any wagons attached to such trains are specially constructed for the purpose, and fitted with such appliances as are generally adopted in the case of passenger carriages. The Board of Trade trust that where the condition of the traffic necessitates the running of mixed trains the passenger carriages will, as far as possible, be placed in front and not in the rear of goods wagons, and that all other precautions will be taken to lessen the risk of conducting traffic on such a system."

The Executive Committee of the Amalgamated Society of Railway Servants has passed the following resolution: "That this committee considering, as practical railway servants, the merits of mixed goods and passenger trains, knows them to be a source of great danger from breaking loose or from the breaking of the axles, and also from the difficulty of stopping the carriages conveniently at the platforms for the passengers to alight without danger; and are further of opinion that this great danger to the public and to the railway servants will exist so long as the wagons and the carriages are not fitted with continuous brakes."

Wootten Locomotives.

THE Reading Railroad has recently received ten new passenger locomotives which, the Philadelphia *Enquirer* says, "are more powerful than any ever owned by the company. They are all supplied with the Wootten fire-box. A few slight changes have been made, the most noticeable in the fire-box. On all engines previously built the top of the fire-box sloped down toward the furnace door. In the new machines there is no slope, but the top is continued straight to the front of the fire-box. This secures a rather larger heating area, and consequently increases the power. The new engines have been tried and give perfect satisfaction. It is said they can run a mile in 42 seconds with a loaded train. This is at the rate of 86 miles an hour. It is believed that, should an emergency require it, a mile could be made in 40 seconds, or perhaps less. There is little probability that such speed will be required. One of the new engines has been assigned to the fast New York train that leaves Ninth and Green streets at half-past seven every morning. Two of them are now working on the Philadelphia & Atlantic City road, which at one time was very deficient in good motive power. Six or eight cars was the maximum an engine could haul and make schedule time, but the new locomotives can take eighteen cars through on time. The other engines are employed on the main line, the Lebanon Valley, and other divisions."

American Association.

PRECISION IN THE MACHINE SHOPS.

AT the recent meeting of the American Association in Buffalo, Prof. W. A. Rogers, as chairman of the committee on accurate standards, tools, and methods in the machine shop, gave an account of his work in that direction, and presented a resumé of his experiments in the use of the microscope in connection with machine tools. In this method, dimensions are read through that instrument from accurately divided scales, or, in some cases, determined by calipers or gauges accurately set by means of a comparator. By this system the workman receives from the tool-room of the shop the necessary number of calipers accurately set to the required dimensions by a skilled attendant in charge of the comparator. It is evident that in this way a high and uniform degree of accuracy may be obtained, with much saving of time and avoidance of errors, in which latter respect we would suggest that cali-

pers be returned to the tool-room unchanged, and their settings checked. For all good work, these methods must supersede the present inaccurate and inconvenient use of scales of but moderate precision, and the setting of calipers by the workman, and they will obviate the necessity of the present expensive standard gauges.

The sort of work done by these gentlemen will mark an era in the development of machine construction.

BRIDGE STRAINS.

At the same meeting Prof. Webb, of Hoboken, presented his method of determining maximum points and stresses in bridge inclines, which are applicable to trusses of the most irregular form, and to any style of loading, irregular or uniform. The method, as applied to the graphical determination of strains, was illustrated by blackboard sketches and finished drawings, and some of the features of a new notation were explained.

CYLINDER CONDENSATION.

Prof. De Volsen Wood read a paper, in which he called attention to the effect of variation in speed upon cylinder condensation, illustrating the same by experimental figures.

New Method of Making Water Gas.

THE Glasgow *Engineer* says that a new method of making water gas at an extremely low cost was the subject of a recent communication to the French Academy of Science, and that "the matter has caused much anxious attention not only in France, but all over Europe and in England as well." It is of weighty importance not only to gas but also to iron makers, if it accomplishes what is predicted of it. A jet of superheated steam is directed into a retort full of incandescent coke. The oxygen unites with carbon to form carbonic acid, and hydrogen is liberated. So far nothing new. The gases are led to a second retort filled with some refractory substance kept red hot, by which a glowing surface is exposed to the gases. At the same time superheated steam is introduced. This seizes upon the carbonic oxide to form dioxide and more hydrogen is liberated. A milk-of-lime bath removes the carbonic dioxide, and the pure hydrogen is led to a reservoir. One ton of coke in this process produces about 69,000 feet of gas, which is about eleven times the quantity usually produced by the expenditure of a ton of coal. This reduces the cost to little, if anything more than that of natural gas, when the difficulty of controlling the latter is taken into the account. This is for heating purposes. Inventors are at work devising the best methods of carburetting it, and Boulogne-sur-Seine is to be lighted with it next winter.

Durability of Locomotives.

ENGLISH engineers are giving no small degree of attention to the durability of their locomotives. The statistical details should be put in book form and preserved, as they will become interesting as the competition between the American and English type of engine increases. Mr. Johnson, of the Midland Railway, confines himself to breakdowns. In 1885, there were 60 cases in which an engine was rendered idle for half a day or more. Among the causes was the breakage of crank and straight axles, slide-valves, and valve spindles, through wear and tear; also cases of hot guide-bars, due to neglect on the part of drivers; and cases where drivers had to give up their trains. The gross engine mileage for 1885 was 43,658,427. The total number of engines 1,803. The average mileage, supposing all the engines to have been worked, 24,200. There was one breakdown for every 727,624 miles. This includes engines of all kinds.

A Notable Inventor.

THE following is copied from an English paper: "George Westinghouse owes his great and rapidly increasing wealth to his inventive genius. Twenty years ago, he was a poor young man, but he struck it rich in his air-brake for railroads, and money has since flowed into his coffers in a golden stream. He is one of the most prolific inventors of the age, and has enough good mechanical ideas to furnish every manufacturing establishment in Pittsburgh with successful specialties. He is not only highly skilled in theoretical and practical mechanics, but is also a thorough electrician. He expends an ordinary fortune every year in experiments necessary to the perfection of his inventions. By warrant of the King of Belgium he is entitled to the title of Sir George Westinghouse, having been knighted by that monarch as a recognition of his services to the world as an inventor. He is a native of New York State, and is about forty years old.

The Relative Value of Natural Gas and Coal.

OF Pittsburgh coal 55.4 pounds contain the same number of heat units as 1,000 cubic feet of natural gas. With coal at $1.20 per ton, 1,000 feet of natural gas would then be worth 3⅓ cents. But by tests made by the Westinghouse Air Brake Company, 1.18 cubic feet of natural gas evaporated one pound of water from 190° F. with the same boiler under which one pound of the best coal evaporated 10.38 pounds of water. That is, one pound coal equals 12.25 cubic feet gas, or 1,000 feet gas equal 81$\frac{8}{16}$ pounds coal. This difference results from the expenditure of heat necessary to raise solid fuel to the gaseous state, which must be done before combustion can take place. In a house-grate the loss on this score from using coal would be more than in a large furnace of a factory. Hence, the greater economy in the use of natural gas is in houses and small establishments.

Feed-Water Heaters.

THE Feed-Water Heater Company, of St. Johnsbury, Vt., recently experimented on the Connecticut River road with some of their heaters, with the following result: Three heaters on engines drawing light two and three-car passenger trains 350 miles per day for ten days, connected, and same disconnected, show a total saving of 20,090 pounds of coal, or an average of nearly 700 pounds, which is equivalent to 17 per cent. of fuel saved per heater per day.

The Hinckley Locomotive Works, of Boston, which have been shut down for fourteen months, are to be started up again if the general improvement, now beginning to be felt, continues. The works have never before been shut down for so long a period.

CORRESPONDENCE.

MINNEWASKA, ULSTER COUNTY, N. Y.

To the Editor of the American Railroad Journal:

MY attention has been called to the July number of the AMERICAN RAILROAD JOURNAL, in which is published a letter written by me in 1884 to the Rogers Locomotive Works, referring to the interview with Mr. Thomas Rogers that determined the existence of the Rogers Locomotive Works.

I find in same number reference to the dates of earlier six and eight-wheel locomotives. Perhaps it will aid to more definite knowledge of the date of the earliest movement in that direction, to publish that part of a report to the South Carolina Railroad Company by me, of date May 16th, 1831, as to the necessity of six and eight-wheel locomotives, which sets forth the considerations as to the *necessity* and the conditions to be complied with in reference to change of grades and changes in direction. It will be learned from the report what were the measures proposed (and subsequently carried into practice by me on that road), and which are substantially those which continue to this day.

To a statement of mere personal interest allow me to refer: I was not, as stated, "a resident engineer on the line of railroad" for which the three locomotives were built, nor was I then "deputized to go to England and have the three engines built on plans to be decided by me." It is of no interest to any one how it happened that I was entrusted with that responsibility, but it may be allowed the old engineer (as some people count oldness) to bear in mind, and with no diminishing interest, the personal acts of the young engineer (then only a canal resident engineer) in deciding to go to the place where alone on the face of the earth the locomotive had begun *to be*, and, as I believed, was to continue to be, and, as I now know, some sixty years later, yet continues to be the great motor on all railroads; and, again, as a matter of belief, will continue to be. It was after this decision of my own that I was entrusted, greatly to my gratification, to have built the three locomotives as named.

If it happens that you do not have a copy of the "Railroad Era" pamphlet, a copy will be sent you with the good wishes of one who took the AMERICAN RAILROAD JOURNAL from its first number in 1832, and for very many years thereafter.

The pamphlet is marked copyright, as at one time I had thought some one might care to give it a wide circulation, as the facts deserve. Extracts to any extent are at your service.

When at home my address is Homewood, South Orange, N. J. HORATIO ALLEN.

[The following is the portion of the report referred to by Mr. Allen:]

"When we come to consider the application of locomotives to *wooden roads*, there are circumstances which call for attention, and a particular adaptation of arrangement to them. As the same amount of attendance and repairs attend engines of the various powers within the range that can be employed on railroads, it becomes a highly important object to place as great a quantity of power within one machine as possible. And this is more peculiarly the case on a road where the great and most difficult sources of expense are the attendance and repairs, while the fuel is comparatively of little consequence. As on every road there exists a *limit of weight* to be placed on each pair of wheels, and as on wooden roads this limit is much less than on an iron one, it becomes a still more interesting inquiry to ascertain by what means we way increase the quantity of power without exceeding the limit. On the Liverpool & Manchester road they appear practically to be limited to three tons on each pair of wheels, though some accounts state this to be too high, with their velocity, for the permanent benefit of the road. On a wooden road, where only one-half inch iron is made use of, I would put the limit at one and a half tons per pair of wheels

"If, therefore, there can be no arrangements whereby this disadvantageous relation may be provided for, it is evident that, to convey the same quantity of goods or transport the same number of passengers, we must incur twice the expense of attendance, twice the amount of repair, and twice the liability to accident. In fact, more than twice, since in doubling the weight of the engine we are able to appropriate a greater proportion of the increased weight to steam generating purposes.

"The arrangement (?) which I would propose to effect so desirable an object would be, as the limit exists in the quantity on each point of support, to increase the number of supports, *and thus distribute the weight over a greater surface*. I would, therefore, place the engine on six or eight wheels, and limit the weight to one and a half tons to each pair.

"There arise two objections to this arrangement, from the inequalities in the line of support; the one vertical, the other horizontal.

"If three or four wheels were united on a side to the same rigid straight line, and the road had irregularities in its surface, there would arise great and injurious strains to the structure, from the wheels not being able to adapt themselves to the irregularities.

"This difficulty may be completely obviated by giving the weight to be supported but two points of support on each side, and making these points the centers of motion of the pairs of wheels.

"This arrangement will evidently adapt itself with as much ease and simplicity to all vertical irregularities, as is the case with two wagons connected together. As to the change of direction horizontally, as in the entrance of turn-outs and the passage of curves, a very simple adjustment will relieve the arrangement from all difficulty. If we connect the frame with the cross-piece only at the center, and by a horizontal point, the two sets of wheels will thereby be enabled to pass all curvatures with the facility of two simple wagons connected in the ordinary manner."

A Silver Medal to a Railway Porter.

J. THORNBOROUGH, a railway porter at Kidderminster in England, was recently presented with a silver medal of the Order of St. John of Jerusalem, for an act of heroism performed at the station in July of last year in rescuing a woman named Perkins, who had thrown herself in front of an approaching train. Lord Lyttelton, in presenting the medal, said: "They were met to reward Joseph Thornborough for a great act of heroism, and he should not depreciate the brave act done if he said that there had been many instances of bravery and devotion performed by railway servants, almost week by week, which had never been brought under the gaze of the public. It was by such acts as these that the public were able to judge what sort of men the railway servants were. (Cheers.) The railway servants of the country formed a band of 300,000 men, and they would bear favorable comparison with any body of picked men, even including our soldiers and sailors, in the country. In the great qualities of fidelity to their employers, presence of mind and resource in the moment of peril, courage and anxious care for the interests and safety of those committed to their charge, they would defy competition with any body of men that could be found. (Cheers.) It was a great advantage to a country to have such a body of intelligent, disciplined men who are ready to show such great qualities as had been displayed by Thornborough. He had great pleasure in presenting the silver medal and the certificate of the order to him, and hoped that it would prove a stimulus to all railway servants to be as daring in the hour of peril."

Porter Thornborough, in receiving the gifts, said "he felt he had only done his duty, and it was an act which he should repeat in the future if similar circumstances presented themselves." (Applause).

NOTES AND NEWS.

WILLIAM SELLERS & CO., INCORPORATED:—The title of the well-known firm of William Sellers & Co., Philadelphia, has been changed to "William Sellers & Co., Incorporated."

LIMIT TO NUMBER OF PASSENGERS ON STREET-CARS:—The Humane Society of Pittsburgh proposes to secure the passage of a law requiring horse-car conductors to display a sign whenever the prescribed limit as to number of passengers is reached. What is the prescribed limit? No one ever saw it reached in this part of the country.

THE FATALITY OF COUPLING CARS IN ENGLAND:—Mr. Clement E. Stretton, Vice President and Consulting Engineer of the Amalgamated Society of Railway Servants, says that in seven years 1.081 men been have killed, and 9,256 injured during "shunting" operations, or, in other words, 10,337 have been killed or injured out of a total of 14,000.

NIGHT SCHOOL FOR MECHANICS:—At Cedar Rapids, Iowa, Mr. Bushnell, Master Mechanic of the Cedar Rapids & Northern Railroad, has established a night school for mechanics and apprentices, who are kept from drawing, etc., until they are thoroughly grounded in the necessary mathematics. There are many applications from the best class of young men for admission to the school.

COLOR BLINDNESS:—Dr. Worms has recently brought before the Paris Academy of Medicine the results of his investigations concerning color blindness. He has examined 11,175 persons. Two of these only were incapable of distinguishing one color from another, three were blind for red and six for green, 18 could not distinguish green from red, 15 saw no difference between green or blue or grey, and 52 had a peculiar weakness in color vision in general.

ELECTRICAL TRANSMISSION OF FORCE:—A committee appointed to witness M. Marcel Desprez's experiments on the transmission of force by means of electricity, recently held a meeting in Paris. The problem was to take 200 horse-power at Creil, 56 kilometers (34¾ miles) from Paris, and to deliver half that amount in Paris. In fact, the horse power in Creil was 88; in Paris it was 40. Upon the whole the experiment succeeded well enough, and the results are satisfactory.

EARTHQUAKE ACCIDENTS:—One of the strangest occurrences attending the earthquake in South Carolina, was the wrecking of the Columbia train near Ten Mile Hill. It is said that the earth suddenly gave way and that the engine first plunged down the temporary declivity. It was then raised on the top of the succeeding undulation, and, having reached the top of the wave, a sudden swerving of the force to the right and left hurled the ill-fated train down the embankment.

HOT BEARINGS.—A tell-tale paint for showing when a bearing is growing hot, has been brought out by Mr. Henry Crookes, of 4 Westminster Chambers, S. W. At normal temperature it is a brilliant red, but as it is heated it grows darker, until, at 180° Fahr., it is quite brown. As it cools, it regains its original color again. If the bearings of an engine or machine be covered with paint, the man in charge can tell at a glance if they are running cool; and if they become hot, he can watch from a distance the effect of the lubricant he applies.

LOSS OF LIFE AND INJURIES ON BRITISH RAILWAYS:—British railway traveling cost 957 lives last year, besides injuring 3,467 people. The large majority of sufferers were railway servants, 451 being killed, and 2,117 injured. Of the passengers only six were killed, and 436 injured by accidents to trains, the remaining disasters being due to miscellaneous causes, and often through the passengers' own fault, such as trespassing, suicide, and carelessly crossing the lines. In proportion to the traffic, only one passenger was killed in over 6,075,000 travelers.

TESTS OF STEEL AND IRON GIRDERS:—Messrs. De Bergue & Co., of Manchester, have recently made a series of important tests on Bessemer steel and iron girders. These tests, which have been carried out under the direction of Messrs. Barningham Brothers, of Manchester, on behalf of the Darlington Steel and Iron Company, have had for their special object the determining of the relative strength of steel and iron for structural purposes, and the general results obtained were, with equal sections, about 40 to 50 per cent. in favor of the steel as compared with the iron girders.

APPRENTICES:—The Chicago & Alton Railroad takes a certain number of apprentices into its shops on the following conditions: There is a three months' novitiate to see if the candidate has mechanical aptitude; if accepted, he is then registered as an apprentice for three years and three months. The wages paid are:

For first three months	55 cents per day.
For next twelve months	58 cents per day.
For next fifteen months	75 cents per day.
For next twelve months	$1 10 per day.

No indentures are required, and the right of suspension or discharge is reserved. Apprentices must have an order from parents or guardians to enable them to draw their wages.

THE PACIFIC RAILROAD OF SOUTH AMERICA:—The construction of the first section of the great Pacific Railway which is to connect Buenos Ayres and Valparaiso will, the *Buenos Ayres Standard* of July 16th says, be commenced before the end of the month current, starting from Palermo Park, where it will have a junction with the Northern Railway. Mr. Clark's plans have been approved by the National Government, with some trifling alterations. The section will be sixty miles in length, and will traverse the most thickly settled districts, passing south of Luxan, not far from Mr. John Brown's estancia of La Choza, and meeting the portion of the Pacific line already made at Mercedes.

EXTENDED PISTON-ROD FOR LOCOMOTIVES:—The shops of the Great Western Division, Grand Trunk, in Hamilton, Ont., are now building some heavy passenger-engines. The engines have 6-foot drivers, and 19×24-inch cylinders. In order to give proper support to the piston, and prevent it dragging on the bottom of the cylinder, the piston-rod is prolonged through the front cover, and, therefore, supported at each end by suitable bushes and glands. This device is used in many large marine and stationary engines, but is, on locomotives, the revival of an old practice which was used on some eastern roads twenty-five or thirty years ago. It is now often used in Germany and France. The result of the experiment on the Great Western will be awaited with considerable interest.

THE PREVENTION OF A STRIKE:—Many strikes might be avoided if the course just followed in the Harmony Cotton Mills at Cohoes, N. Y., were generally adopted. The men wanted more pay, but the company told them that they could not afford an advance, and that they were already paying as much as mills in their line at Fall River and elsewhere. The men did not believe it, whereupon the manufacturers offered, if the men would select a reliable man to travel about the mills and look up the subject of wages, to pay all his expenses, and to raise the wages if they were not as high as paid elsewhere. A boss weaver has been through Massachusetts and has gone back to Cohoes with the statement that the wages there are as high as any paid in the country, and that his fellow workmen have no cause to complain.

OVERTIME AND PIECE-WORK:—At the recent Trade Congress held at Hull, Mr. Broadhurst, M. P., moved "That, in the opinion of the congress, the systematic working of overtime in many of the skilled trades of the country is an evil to the persons so engaged, and an injustice to the large body of unemployed, and should, therefore, be discontinued whenever the unions have sufficient influence for this purpose. Also that the system of piece-work, except in such trades where standard prices can be classified and maintained, is an injury to the moral, physical, and social well-being of the working people." Overtime, he said, was an enormous injustice to those out of employment, and they all agreed that 48 hours per week were sufficient for a man to labor. The congress got into a "scene" over the resolution, and it was lost.

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Principal Contents of this Number.

ANNOUNCEMENT.

THE AMERICAN RAILROAD JOURNAL has been sold to Mr. M. N. FORNEY, who will be its editor and owner from this date. He has also arranged for the purchase of *Van Nostrand's Engineering Magazine* on the completion of its current volume at the end of this year. The two publications will then be consolidated with the title of the AMERICAN ENGINEERING MAGAZINE AND RAILROAD JOURNAL, which will be devoted to the discussion of engineering and mechanical subjects. Railroad construction and operation being, however, the most important branches of engineering in this country, more space will be devoted to them than to any other one department of engineering. Questions of traffic and finance will not be taken up, excepting so far as they are incidentally concerned with engineering matters.

The new publication will have, each month, about double the amount of reading matter heretofore contained in the RAILROAD JOURNAL—the subscription price, $3.00 per year, will remain the same as heretofore.

The office of publication will hereafter be at No. 23 Murray street, New York.

PROFIT AND LOSS IN CARS.

IN the September number of the JOURNAL we published a very interesting and valuable paper on the "Life and Profits of a Car," which was read by Mr. E. C. SPALDING, of the Western & Atlantic Railroad, at the Car Accountants' Convention at Buffalo. In that article he gave a table, which is reproduced below, and which shows the average mileage made by cars of various ages, and also the cost of repairs done, thus giving the average revenue, expense, and net profit or loss by cars of various ages:

EARNINGS OF BOX-CARS IN GENERAL SERVICE.

Mileage.	Money.	Repairs.	Net Profit.	Per cent. Profit.	Net Loss.	Per ct. Loss.	Age of car. Years.
13,149	$98.62	$9.58	$89.04	18			1
13,478	101.08	38.13	62.95	12½			2
10,475	78.56	48.24	30.32	6			3
9,847	73.85	45.85	28.00	6			4
9,881	74.11	57.31	16.80	3			5
9,349	70.12	70.74			$0.62	1-9	6
8,968	67.26	60.74	6.52	1¼			7
9,250	69.37	55.49	13.88	2 4-5			8
9,295	69.71	49.80	19.91	4			9
7,656	57.42	53.67	3.75	¾			10

The cost of cars he assumed to be $500 each, and he points out that for the first five years of a cars' life it is a good investment, but after that it is not profitable to run it. The data which Mr. SPALDING has given is of very great value, and the paper is a model in the way of giving the information it contains in a brief and perfectly lucid form. If data of a similar character were collected on other roads and tabulated in a similar way, so as to get a broader average of the earnings and expenses of cars, it

would add to the value of the information which the author of the paper quoted from has contributed to the railroad companies of the country.

But while the facts which are given in the above table are very valuable, the reasoning and the deductions therefrom are open to question. Mr. SPALDING assumes that, when the net profit on a car no longer pays interest on its first cost, it is not profitable to run it. This would be true, if a company could get back the original cost of the car by destroying it. But if a car is broken up, the value of the old material instead of being $500 is only about $150. Therefore, so long as the car earns interest on the value of the old material, it would be profitable to run it as an investment. The earnings of the car should, however, not only pay interest on its cost, but should also pay *for the difference in value between its cost when new and that of the old material when destroyed.* The net profits given in the table are not sufficient to do this, and if money is worth five per cent. to the owners of the cars whose earnings are given, they are, according to the figures in the table, losing money. This can be shown if we put the cost, and interest on cost, of car in one column, and the net profits and the value of old material at the end of ten years in another, as follows:

	Cost of Car $500.00	Net Profit.
First year, Interest on Cost of Car.....	$25.00	$89.04
Second " " " "	25.00	62.95
Third " " " "	25.00	30.32
Fourth " " " "	25.00	28.00
Fifth " " " "	25.00	16.80
Sixth " " " "	25.00	
Seventh" " " "	25.00	6.52
Eighth " " " "	25.00	13.88
Ninth " " " "	25.00	19.91
Tenth " " " "	25.00	3.75
	$750.00	$271.17
Value of old material in car		150.00
	$750.00	$421.17
Loss on car service at end of tenth year.....		328.83
	$750.00	$750.00

These figures show that foreign car service does not result in a fair profit on the investment to the company owning the cars, whose earnings are reported by Mr. SPALDING. It is, therefore, very desirable that similar data should be procured from other roads, to see whether the results indicated are the same on other lines. The mileage of the older cars reported in the table seems to be very small, and it may be that the cost of repairs is higher than elsewhere. At any rate, it is very important that railroad companies should know whether they are making or losing money from their foreign car service.

Some light ought also to be thrown on the cost of repairs. Where does that money go to? If we could ascertain how much it costs to maintain the different parts of cars, we could then know the direction in which improvement is most needed. No better or more valuable piece of work could be done than to classify the cost of the repairs to freight-cars in any shop in the country, so as to be able to give the expense of maintenance of say, wheels, axles, journal bearings, trucks, draw-gear, car-bodies, roofs, and painting. It is not certain that this is the best subdivision that could be adopted; it is given merely as a suggestion, and any one having experience in keeping the accounts of a repair-shop could probably improve on it. This work would not require more than fair clerical ability, and could be done by any intelligent clerk or master car-builder, and if such information were embodied in a paper as clear as that of Mr. SPALDING'S, it would help to establish the reputation of any person who did it. which is often so important to those aiming for advancement.

AUTOMATIC CAR-COUPLERS.

THE *Railway Review*, in commenting on the confused condition in which the car-coupler question has been left by the report made at Niagara last June, and the action of the different State railroad commissions, concludes its remarks with the interrogation: "Is it not about time that something really practical and really earnest should be done with this matter?"

Probably there are few persons who know, or do not know, anything about the subject at issue, who would fail to answer "yes" to this query. The fact is, in life, this question, with reference to other subjects, has a habit of propounding itself in the most inconvenient and often importunate way.

The man or woman who is hard up and "breaks" his last greenback of small denomination, is apt to conclude that it is "about time that something really practical and really earnest should be done." The young maiden who for months or years has increased the paternal gas-bill in listening to the sentiment of her young man, with hope long delayed, often concludes that "it is about time that something really practical and really earnest should be done." An editor whose brain has been squeezed dry so often that it seems as though not a scintillation of a thought could be evolved from it, nevertheless, when the printer clamors for copy, and the time for publication arrives, resolves that "something really practical and really earnest *must* be done." But, the puzzle in such cases, and in that propounded by the editor of the paper quoted from, is to know what to do. Inasmuch as the wisdom of newspapers is not supposed to have any limit, it would, perhaps, be in order to invite our cotemporary to suggest in the form of a "resolution" just what ought to be done; and to say what person or association should adopt the resolution. This will put the contemplated and much demanded action into definite shape, and will, no doubt, receive the attention which the importance of the subject merits.

GAS LOCOMOTIVE.

THE *Scientific American* contains a description of a gas locomotive which has been in successful operation on one of the street-railways at Melbourne, Australia. It consists of a six horse-power Otto gas engine, carried on a carriage which, with the motor, weighs 6¼ tons. The supply of gas is carried in four copper containers, each 16 inches in diameter and about 6 feet long. The total cubical capacity of the four containers is 28 feet. These containers, charged with gas compressed to ten atmospheres, or say 150 pounds per square inch, represent 280 cubic feet of gas stored, which is sufficient for a run of 15 miles. Thus far, the pressure of 100 pounds has never been exceeded, which gives ample supply for running 10 miles.

The gas is compressed by an engine and compressing-pumps fixed near the line; with these the gas is taken from the Metropolitan Company's main and forced into receivers, where it remains under pressure until required for use. When the motor requires a fresh supply of gas, it is brought opposite the receivers, and the containers on the motor are connected by a short India-rubber hose to a pipe leading from the receivers. A tap is then turned, which allows the gas to pass from the receivers to the containers until the pressure is equal, then the tap is closed, the hose disconnected, and the motor is again ready to resume duty. The time required to charge the containers does not exceed two minutes. The time usually taken in running 2½ miles is about sixteen minutes, and the same time is occupied on the return journey. The heaviest gradients are 1 in 50, of which there are three, and the sharpest curve is 18½ chains radius. The number of trips run each day is eight, or a total of about 40 miles per day, except Saturday, when an extra trip is made. The motor has now been working about four months, and the average consumption of compressed gas is 702 cubic feet per day, as measured by the meter through which it is taken.

The engine is fitted with friction gearing, which allows it to work in one direction, and so avoids the delay of stopping and starting.

The power of the gas engine is derived from a fuel which has no weight, of which a large quantity can be carried without adding to the load, and the supply, it has been shown, can be replenished with the greatest ease. No boiler, coal, or coal bunker is required, and one man, not necessarily a mechanic, is all that is needed to take charge.

The fact of a motor of this kind running 40 miles a day for four months has established the principle, and has proved by demonstration what can be done with locomotives on this plan.

Street-Railways.

THE LABOR QUESTION IN JAPAN.

A CORRESPONDENT of the *New York Tribune* gives the following account of the way the Japanese have treated the labor question in that country:

"Street-railways were introduced into Tokio, the capital of Japan, about four years ago. Conferences between employers and workingmen are common events in that country, and before the inauguration of this new enterprise, it was proposed and agreed that, in addition to the regular monthly wages, each driver and conductor should receive a small percentage on the gross receipts of the car to which he might be attached. This proportion was fixed, in most cases, at one per cent., which had the effect of adding one-quarter, or, under fortunate circumstances, one-third to the customary stipend. The purposes on the part of the employers were to keep the drivers on the alert for passengers; to insure such behavior on the part of conductors as should make the line more popular than the old-fashioned omnibuses; and to provide against objections to extra work, when such was thought requisite or desirable. It might be difficult to estimate the possible result of a similar experiment here, and no comparison could well be based upon wage rates so low as those of Japan. Moreover, our capitalists would probably be rather diverted than edified at the idea of receiving hints from the far east on such a subject. Nevertheless, it is interesting to know that the relations between the owners and the laborers have always been harmonious; that nothing resembling a strike has ever been remotely contemplated; that the workmen are willing to perform extra labor on account of the chance it affords for increasing their earnings; and that the capitalists find it well worth while thus to stimulate their people by giving them the trifling share of the gross revenue."

In commenting on the above, a correspondent of the RAILROAD JOURNAL says:

"Japan, a country new in the world of nations, takes a step ahead of the great American Republic. The above letter leads us to ask why some Americans do not improve on the Japanese idea, by paying the street-railroad conductors five per cent. on receipts in excess of $18.00, *in addition* to regular or present wages.

"If, for example, the average receipts of a Sixth Avenue street-car conductor are $20.00 per day, to give him five per cent. on all receipts above $18.00 per day would be an incentive for him to pass over each day, in receipts, all that his car could possibly take in."

It is to be feared that some practical difficulties would be encountered, in actual service, if such a system were adopted. In the first place, the earnings of a street-car are to a very limited extent only dependent upon the efforts of the conductor. A few seconds' time may increase or diminish the receipts very materially. If a driver will run behind his schedule time, he will pick up all the passengers that accumulate along the whole length of the line during those seconds. A percentage on earnings would, therefore, be a constant incentive to "loaf" or run behind time. All travelers on the old omnibus lines on Broadway can remember how the drivers would loiter on the way in order to pick up passengers. To be just in time, and not too late, for the dispersion of the audience of a popular theatre, or other place of amusement or assembly, would make a very material difference in the earnings of a street-car and the percentage of the conduc-

tor, but might cause serious disturbance in the running time of the cars.

It is doubtful, too, whether the plan proposed would be an incentive to honesty, because, if a conductor is not watched, it would be safe to pilfer when the receipts are above the average, and it is only then that he would receive a percentage. In other words, a dishonest conductor could probably make more by stealing from the company than he would get in extra percentage on receipts. Besides, he might steal and also get a percentage which would be only slightly diminished by his stealth.

It is very desirable that all persons who labor in any way should be paid in proportion to the work and the quality of the work they do; but piece-work is very generally opposed by trades unions, and they have some good grounds for their opposition.

We hear a great deal now-a-days about coöperations, and all kinds of schemes are proposed for giving workingmen an interest in the profits on what they produce. The fact is, though, that we can hardly conceive of any organization which would give greater facilities to employés to become coöperators than an ordinary stock company does. Any railroad employé, for example, may acquire an interest in the corporation he works for, by saving his money and buying one or more shares of its stock. He can do this at any time, and if he should be inclined to part with his interest, it can be done without difficulty or delay. He can convert his stock into money, or his money into stock, at any time; and he has the same rights, and privileges, and advantages as the richest owner in the company, proportioned, of course, to the amount of his holdings. It would seem as though it would be a good plan for corporations to encourage their employés to own stock in the companies they work for. This could be done by fostering economy and providing safe depositories for the savings of the employés, and then, when men are employed, giving the preference to those who are holders of stock.

The great difficulty in the way is, that so small a proportion of mankind have sufficient self-restraint to save money; and when it is remembered that capital means simply *savings*, it can be understood why there is and always will be such a wide gulf between those who will and do save, and those who do not. There is a large class of people who find it so difficult, as to be almost impossible, to save anything beyond what is required for subsistence. Such people say, and are now saying it with much vehemence, that "our only capital is our labor, and we want labor's just share in the profits." Probably we shall, within the next decade, see many experiments made in the direction indicated by our correspondent, and there is no doubt that if some method could be evolved which would be mutually advantageous to employer and employé, and which would compensate the laborer in proportion to the value of his work, it would give a fresh stimulus to human progress, comfort and happiness.

CABLE TRAMWAYS.

A WRITER in the *Mechanical World*, after describing the cable roads of San Francisco, says:

"With respect to the control of the cars, the control of the management and the stopping and starting of the cars, that has been tested in almost every conceivable circumstance, and the writer cannot conceive of any manner of stopping a car and bringing the same to an absolute stop in so short a time as is done under the cable system. The man in charge of the grip takes the place of the man in charge of the horses on horse railroads. A horse has a mind of his own, has a brain and heels, and requires the attention of the man in charge to look after him as well as the brake. In the cable system the grip-man looks after the brake and has no horses to look after, and consequently has immediate and absolute control over the starting and stopping of his car. Moreover, he stops it absolutely. When a passenger gets off there is no jerking and grasping hold of the strap to keep his equilibrium, but the car is stopped at once. The writer has seen on Clay street, in San Francisco, where the car has been stopped and a tumbler filled with water held in the hand of the superintendent standing in the car, and the car then started without spilling a drop of the water. This shows what control of the motion of the car a man with some experience at the grip possesses.

"As to noiselessness. All the clatter of the horses is done away with. The cable car moves along smoothly and quietly and regularly, without jerking or thumping on the grades or anything. In fact, the grade makes no difference, so long as it is not so steep as to tumble the passengers into one end of the car. There are grades in San Francisco on the line of the cable railroads from 1 foot in 5 feet; and in the city of Dunedin, in New Zealand, the cars are running on a grade of 1 foot in 4½ feet, and on the Highgate-hill line they are running over grades varying from 1 foot in 12 feet to 1 foot in 7 feet.

"There is also another point to be considered, and that is with regard to the capacity of the cars and the carrying capacity of the road. This capacity is almost unlimited, because there is no limitation to the number of cars which can be used within the horse-power of the engine, and cars can be added within the range of the engine, so as to meet all the varying demands of travel. Single-deck cars or double-deck cars can be used, which can be run in trains of one, two, three, or four extra cars to one grip-car, or can be made up and operated as a single car and grip-car which can be run every quarter of a minute, or with just time enough to keep the way clear. Double-deck cars can be made to carry 44 inside and 32 outside comfortably seated, and with this system there should be no difficulty under ordinary circumstances of furnishing a seat to each passenger, so that the capacity of the system must be considered as unlimited.

"As to the popularity of the system: In San Francisco, as in Chicago, it was found that the horse railroads were

not paying so well as they might, and they had to change them to some other systems; and some of them were converted into cable roads, and such are now paying handsomely. The Sutter street road, which, prior to its conversion into a cable road, had its stock selling for £4 10s. or a little less, is a successful road, and its stock is selling now at £20. They give transfers along their main line running east and west and north and south, parallel with the ocean. The Geary street railroad, which cost about £8 a share to build, to the original stockholders, is selling for from £19 to £21. So it is with the other roads; so it is with the Chicago roads; the stock has advanced.

"Testing the operation of the cable system in the city of Chicago by public opinion, it will perhaps be sufficient to say that the surest way to raise a public clamor is to attempt, when any accident occurs which renders it necessary, the substitution of horses for the cable, and under which the public would have the same facilities precisely as it formerly had. In the city of Chicago, and particularly upon the south side, in public judgment, the cable has become a necessity, and is finally demanded as a right, and nothing draws down upon the Chicago City Railway Company more hearty denunciation and criticism than the substitution of horses for the cable system, even for an hour, whenever the emergency does demand it.

"As to the economy of the system: The economy increases in the cable system in proportion to the amount of business done. That applies to all roads, but you can save from 60 to 75 per cent. in the cost of operating a cable road as compared with a horse railroad. This means that you can operate your road and carry people at a less fare. That affects the public more than anything else.

"It is held by chemists that after snow falls some ammonia is raised in the atmosphere. A little ammonia is beneficial, but not such ammonia as you get from the decomposed urine and its germs, and from the decomposed fæcal matter with its offensive odor. Every horse discharges 10½ pounds of fæcal matter and $4\frac{4}{10}$ gallons of urine per day, thus assisting to render the air impure.

"Horse manure evolves a large proportion of ammonia. Ammonia is considered an unhealthy gas diffused in the atmosphere, when inhaled to a large extent; a little smell of it is very agreeable. But this is hardly a fair way of putting that subject, because, in the liberation of the ammonia, there are other objectionable substances; there is what is called the sulphide of ammonium, which is very unpleasant; and then, in connection, there are germs. As to the question whether the average of the lives of horsemen is lower than the average of the lives of other people, much is not known, but it is a matter of popular belief that men who are engaged in any of these occupations, like plumbing, for instance, do not mind sewer gas at all; that they become used to it.

"While we can, to a large extent, sweep the solid matter up, we cannot do so with the liquid matter, and that soaks into the crevices, and in warm weather undergoes decomposition. The exhalations from the lungs and skin and the gaseous rectal discharges of the 80,000 horses in a city such as New York is a pretty serious matter. A town with 80,000 people in it is a very good-sized town—a crowded city, and here we have this enormous number of animals.

"After the pulverization of the solid matter by hundreds of thousands of wheels, so that we have it in the most favorable condition for a good March wind to blow the dust about, it becomes a very serious matter to the lungs. The fact is, this dust is mostly pulverized manure, and it is blown in the gutters, and if somebody throws the lighted stump of a cigar into it it kindles a fire.

"It is not like dust and earth; it is organic matter in decomposition. This dust may have certain simple mechanical effects. Thus, for instance, it may affect the eyes and nose. It is not only blown into the face, but it is carried in our clothing; and if the ladies with their beautiful dresses and elegant bonnets knew they carried more or less a load of manure on their heads, their bonnets would not, perhaps, please them so much. But it is more serious still; it is taken into our lungs. Let us reflect for a moment; for that which we inhale this way there is no mode of exit. When an autopsy is made of the body of a man who has worked in a coal mine, the lungs are found black with fine dust. If we open the lungs of a man who worked with iron, the oxide of iron gives a redness to the lungs. So, in the lungs of a Londoner, if you should open them you would find manure. See the contrast between the lungs of these and those of a Venetian. Those who have been to Venice know that there is not a single horse there, and, of course, the people cannot get any manure in their lungs. Again, the dust enters our houses, and it has been pointed out and exhibited to our citizens that the dust in our houses is mostly manure. Take a piece of glass and moisten it slightly with glycerine and leave it. It collects the dust, and this is mostly manure. You may close the doors and windows, but it might almost be said of it, as of the dust of the simoon, that it will pass through the shell of an egg. When the summer season comes we have the decomposition of the urinary discharge, and if we come from the fresh air of the seashore into the town, we recognize at once the flavors. Then, again, when urine comes into decomposition we have all kinds of germs developed.

"The construction of these roads and conversion of the other roads from horse roads to cable roads dispense with the services of about three thousand horses in the city of San Francisco. What must be the number of horses in cities such as London, Liverpool, or Glasgow. Of course, when you take into consideration 3,000 horses with their natural droppings, and consider the effect they must have on the sanitary condition of a large city, it must at once strike you that the cable system has an immense advantage over the horse system.

"Under the cable system in Chicago two detentions of short duration took place, and during which the company were compelled to operate with horses on a portion of the lines, owing to weakness and defects in the machinery, which were promptly and easily remedied. Experience corrects all accidents and evils of this character, and the longer the roads are operated the less and less frequent become such detentions, until finally the system has, with us, ripened very nearly into perfection, and it is safe to say with regard to the practical operation of the cable system in the city of Chicago, that if it were put to vote, not one person of either sex out of 10,000 would cast his or her ballot for the restoration of the old method.

"In London the same satisfactory result has been ar-

rived at. During the past winter the traffic upon all the lines in the north of London, except the Highgate cable line, was deranged, and in some instances absolutely stopped, in consequence of the snow storms; but upon the Highgate line not a single trip was lost, and the cars ran as regularly as if nothing had occurred, hauling up the hill wagons heavily laden with coal and other goods.

"The most marked and decided effect of the adoption of the cable over the horse system is the improvement in the grade of men employed, not only in the grade of men generally, but in the same man, when he is promoted from the driving of a horse to the handling and management of a cable-car.

"Wherever the cable system has been introduced and tried, people are pleased with it. They feel relieved, from the simple fact that it does away with any anxiety as to trouble with the horses, and they feel they are not imposing upon animals to exert themselves to do all they can, and more than they should, in carrying them in their daily travel; besides, they are carried surer, quicker, cheaper and more agreeably. It is found by experience that there is less danger in entering and alighting with respect to cable railroad cars. This is a matter of great importance, especially in respect to children, aged and infirm persons; and it is generally stated, more particularly by persons of advanced years, who find it difficult to get on and off street-cars propelled by horses, that the cable system has relieved them of immense anxiety in this respect. This is because the man in charge of the grip has nothing to do but to run that. His business is to manage the grip. His mind is left free except in regard to the grip, and he has complete control of it."

Glasgow Street-Railways.

THE street-railways of Glasgow (Scotland) are owned by the municipal authorities and are worked on the principle of being a source of revenue to the rate-payers of the city. In 1871, the Glasgow corporation obtained parliamentary powers to borrow money for the purpose of constructing a complete tramway system throughout the city; and when the lines were finished they were leased to the Glasgow Tramway Company for twenty-three years on the following terms: Payment of (1) the rate of interest on the actual money borrowed to construct the works; (2) payment of 3 per cent. on the actual cost, to form a sinking fund to wipe out the cost of the works by the expiration of the lease in 1894; (3) payment of 4 per cent. to form a renewal fund, and (4) a rent in the form of £150 per annum for every mile of tramway in actual use within the city boundary. The tramway company also lodged with the corporation bonds on heritable property to the extent of £60,000, as a pledge that they would implement their bargain. The various payments the tramway company have to make to the city authorities in terms of the lease, amount in the aggregate to £29,000 per annum, or £560 a week. The permanent way is kept in order by the tramway company, who are reimbursed for any repairs they make, out of the renewal fund lodged by them with the corporation. Practically, the lines are not only a source of income to the corporation, but their cost is being gradually wiped out, and at the close of the present lease the city will be in possession of a valuable property that has not cost the citizens a single penny.

The tramway company, who work the lines and who possess a complete monopoly of the street passenger traffic of Glasgow, is a good dividend-paying concern, their highest distribution of profits being 11⅓ per cent., and their yearly average from the beginning until the present date 6 per cent. Recently, an underground railway was opened, but as yet it has had no material effect on the drawings of the tramway company. The capital of the tramway company amounts to £315,000; the miles in operation, 26 miles of double road (steel); and the passengers carried, over 800,000 a week. A uniform charge of one penny (two cents) per mile is made for each passenger, inside and outside the cars alike, and the city is marked off into mile and half-mile stations, so as to enable the conductors to levy the fares. Children between five and twelve years of age are charged half fare, and a special service of workmen's cars is run at the reduced charge of one-half penny (one cent) per mile. An elaborate system is in operation to prevent dishonesty on the part of employés, the salient features of which are the use of the bell-punch, and the depositing of £2 by each conductor as security for his intromissions. The cars are drawn by horses, the directors of the company being of opinion that they can obtain better financial results in that way than by the use of steam. The company have everything within themselves, that is to say, they construct cars, make harness for horses, and have shoeing forges, and a block of dwelling houses for their workmen. Their stud consists of 2,507 animals (2,253 horses and 254 mules), and the distance run daily is about 12¼ miles by each team. Provender, an important item in tramway management, is dealt with in this way. Each horse is allowed 27½ pounds of food daily, made up as follows: Maize, 11 pounds; hay, 9 pounds; oats, 6½ pounds; bran, ½ pound, and linseed, ½ pound. In addition to the passenger fares, the company draw a revenue for advertisements displayed on their cars, the carriage of parcels, the carriage of mails between the different railway stations in Glasgow and the general post-office by special vans, and the conveyance of letter carriers from the post-office to the various delivery districts, also by special vans. A limited number of cars are run on Sundays. In one of the suburbs of Glasgow there is a tramway line worked by steam, but this is a comparatively small concern. The directors of the Glasgow Company do not desire steam-cars, but, even if they did, it is unlikely that parliament would sanction the use of steam in the streets of a busy city.—*Bradstreet's.*

Cable "Tramways."

IN a report on this subject, the Public Works Committee of Birmingham, England, arrived at the following conclusions:

"1. That the cable system is practical and suitable for the routes proposed.

"2. That under proper regulations it appears to be as safe, if not safer, than steam, and as safe as horse traction.

"3. That with a frequent service of cars, it appears to be cheaper to work than horse traction, and as cheap as steam traction, even with the extra capital outlay.

"4. That it possesses advantages over steam traction in being more free from noise, entirely free from smoke, steam, or fumes, and less unsightly.

"5. That it avoids cruelty to horses.

"6. That it possesses advantages over both steam and horse traction, in uniformity of speed, in admitting of more frequent service, in power of expansion to meet sudden emergencies at little increased cost, in being able to ascend steep grades with ease, and generally it appears to possess fewer inconveniences and annoyances to the householders on the line of route, interferes less with vehicular traffic, and affords greater advantages to the users of the cars than other systems in practical work."

Due consideration was given to locomotives, compressed-air, and electrical motors, but the latter were discarded at an early stage as impracticable or uneconomical.

The Hours of Tramway Men.

THE directors of the North Metropolitan Tramways Company have little or no sympathy with the talk about "slavery" and overwork among their employés to which many of the London public are addicted. Thirteen and a half hours per day of continuous work during a week of ten days, with meals taken on the car, they seem to regard as matters of no great moment. We do not agree with them. Statistics may not perhaps be sufficiently exact to show how much health per annum is lost under these arrangements. That the loss is considerable, we do not doubt. The system is one of unthinking and unwholesome hurry, and cannot fail to balance its money profit by a culpable and extravagant waste of human working power. Snatched meals are condemned by an all but universal trade custom, while the ten-day labor period has been tried before and has failed, even under the daily working conditions of the last century, which were probably far easier than our own.—*The Lancet.*

Expectoration.

THE New York Elevated Railroad has put up the following notice in the new cars recently put on the line:

"Passengers are requested not to expectorate from the car windows."

The number of pigs who travel on the elevated road, and who spit out of the windows, is so large that such a notice was required to restrain them. Their kind are, however, proverbially hard to influence or control, and it is to be feared that the notice will not have its desired effect. It will, however, amuse our English brethren. If their jeers would lessen what some one has called the "abomination of expectoration" in this country, many of us would, however, be willing to submit to them.

Cable Traction.

IN a discussion of this subject before the Institute of Civil Engineers, Mr. J. H. Greathead, as a result of careful investigations, stated that the proportion of power actually or effectually utilized for carrying the live load (*i. e.*, passengers) upon the underground system of railroads in London, was only something like two per cent. of the total maximum power exerted.

Locomotives on Tramways.

STEAM power seems to be very much more extensively used on what they call "tramways" in England, than in this country. One of the manuals published in that country reports 327 engines employed on such roads at the end of 1885.

STREET-RAILWAY NEWS.

ALABAMA.

THE East Lake Land Company has laid out a new town five miles from Birmingham, and will build a street-railroad from there to Birmingham.

At Birmingham, the Birmingham & New Pittsburgh Railroad Company, capital stock $100,000, has been incorporated by Enoch Ensley, Thomas D. Radcliff, Rufus H. Haygood, and others.

CONNECTICUT.

A horse-railroad is to be built at Stamford, and work will be commenced as soon as possible.

GEORGIA.

Covington will soon have another street-railroad. W. C. Clark & Co., of that city, are interested in it.

At Thomasville the building of a street railroad is being agitated, and meets with general approval.

At Dublin a street-railroad is to be built by R. Hightower, J. M. Smith, and others. The work will be commenced soon.

At Atlanta the Metropolitan Street-Railroad Company will extend the Washington street line on Ormond and Pryor streets to the East Tennessee, Virginia & Georgia Railroad. This extension will open up some desirable property for suburban homes.

ILLINOIS.

The North Chicago City Railroad Company is preparing to erect the station at the corner of Elm and Clark streets for the new cable machinery.

The Rapid Transit Car Company has been incorporated in Chicago by James Whalang, Chicago; F. A. Woodford, and others. It was said to be in connection with the North Chicago City Railroad Company, but President Yerkes has denied this.

KANSAS.

The Scott City Street-Railroad Company has been incorporated by T. J. Smith, Charles Noel, and others. Capital stock, $27,000.

The La Crosse, Walnut City & Rush Center Street-Railroad Company, capital stock $150,000, has been incorporated.

At Wichita the Riverside & Suburban Railroad Company has been incorporated to build a railroad from Wichita to the addition of Riverside. Directors, J. O. Davidson, Wm. Innes, and others. Capital, $100,000.

The Dighton & Watson Street-Railroad Company, capital stock $25,000, has been incorporated. The directors are Geo. E. Long, Dighton; A. Horton, Ness City, and others.

KENTUCKY.

Owensboro is to have a street-railroad. Geo. M. Fletcher and J. M. Bass, both of Nashville, Tenn., are interested.

MARYLAND.

A branch of the Baltimore & Hampden Electric Railroad, to West Hampden or Sweet Air, formerly operated by horses, is to be converted into an electric line. The electric conductor, however, will be overhead, connecting by a wire and traveler with the motor, instead of being a center rail on which a copper wheel runs, as on the main line.

MASSACHUSETTS.

The directors of the Metropolitan Horse-Railroad Company, of Boston, having voted to introduce electricity or cables, will send a committee to investigate the systems at New York, Philadelphia, Baltimore, Chicago, and other places.

At Fall River the Globe Street-Railroad Company has been authorized to extend its tracks on South Main street to the Shove mill.

MICHIGAN.

The Port Huron Electric Railroad Company, capital $25,000, has been incorporated. W. F. Botsford is one of the incorporators.

MINNESOTA.

The motor line at St. Paul, on the west side, is said to be making money, and to promise to be a financially successful enterprise.

NEBRASKA.

The Omaha Cable Company has been restrained, by a temporary injunction granted to the Omaha Horse-Car Company, from proceeding with the laying of its cable. Unless there is some amicable arrangement made, it is probable that much litigation will ensue.

NEW JERSEY.

All the stock of the West Orange Horse-Car Company has been subscribed for, and the track and stables will be put in hand speedily. The company has applied to the Town Committee for authority to lay tracks on Washington street to Valley road.

NEW YORK.

Proposed extensions of the St. Nicholas Avenue & Cross-Town Railroad Company are as follows: From Harlem River along East 116th street, and Manhattan avenue to the north end of St. Nicholas avenue; from St. Nicholas avenue along 126th street, Lawrence street, Broadway, 129th and 130th streets; from St. Nicholas avenue along 131st street to Fourth avenue, and 128th street to Second avenue; along Third avenue, 129th street to Fourth avenue; and from 129th street along Fourth avenue east of the Harlem Railroad, to connect with tracks at 128th street.

The Third Ward Street-Railroad Company, of Syracuse, proposes to extend the line as at present projected to Burnet Park, making the road six miles long.

NORTH CAROLINA.

The Raleigh Street-Railroad Company will soon begin work on a new line in that city.

PENNSYLVANIA.

The Van De Poele Electric Manufacturing Company has contracted to build 2¾ miles of electrical road for the Scranton Suburban Railroad Company. This is one of several projects for electric street-railroads now under consideration in several cities of this State.

TENNESSEE.

At Memphis it was recently proposed to sell the two street-railroads to a syndicate composed of Boston and New York capitalists; to form a new company with a capital of $250,000. The lines cover over 30 miles of streets and the price was to be $1,000,000. The scheme fell through in consequence of the refusal of one small stockholder to sell his stock. W. D. Bethel, of Memphis, acted as the representative of the eastern syndicate.

TEXAS.

At Marshall a company has been formed by Charles Cobb, W. L. Sloan and C. A. Ginnocho, to build a street-railroad.

VIRGINIA.

A street-railroad is to be built from Old Point Comfort to Hampton. It is expected to receive considerable patronage from visitors and tourists.

WISCONSIN.

The Van De Poele Electric Street-Railroad in Appleton has been put into operation with very satisfactory results.

The Menasha Street-Railroad, according to the contractor, Mr. George Wolff, will be completed to Appleton by October. Some trouble has been experienced in getting the rails, causing considerable delay.

FOREIGN.

CANADA.

The Toronto Electric Light Company has built a new locomotive for the electric railroad at the exhibition. It is of a novel design and is about 40-horse power. The headlight, car-lamps, signal-bell, braking, stopping and starting will all be operated by electricity, controlled by switch-levers on the forward end of the motor-car.

The Montreal Street-Railroad Company is getting most of its cars built in the Dominion. Closed cars have been ordered in the States, as Canadian manufacturers have not the facilities for constructing such cars in time. All the open cars are built by Lariviere, and ten more were recently ordered. Next year the closed cars, which cost $1,000 each, will be ordered from there, probably. Lariviere (of Montreal) is also building twenty sleighs for the company. The car-wheels come from Baltimore, Md.

FRANCE.

In Paris, in 1885, the number of passengers carried by the street-railroads, Belt Railroad, omnibuses, and river steamers on the Seine, was 277,944,000.

SYRIA.

It has rather a queer sound to hear that the first horse-railroad in the country is being built by a native company in the ancient city of Damascus.

THE cable system is about to be adopted at Birmingham, England, on about six miles of road, and in Edinburgh about five miles. In the first-named town the road is practically level, but at Edinburgh there are some rather stiff gradients.

Manufactures.

THE ROGERS LOCOMOTIVE AND MACHINE WORKS.

(Continued from page 182.)

CHAPTER IV.

HISTORY OF LOCOMOTIVE BUILDING AT THE ROGERS LOCOMOTIVE AND MACHINE WORKS.

ON the death of Mr. Thomas Rogers, which occurred in 1856, the business theretofore conducted by Rogers, Ketchum & Grosvenor was reörganized under a charter, with the title of The Rogers Locomotive & Machine Works, and Mr. William S. Hudson was then appointed superintendent. He was a prolific inventor and an excellent mechanic, and introduced many improvements in locomotive construction, which will be described further on.

The first "Mogul" engine, Fig. 26, built at the Rogers Works, was completed in 1863. This plan of locomotive was made possible by the invention of the Bissell truck and the addition of the swing links to it by A. F. Smith,

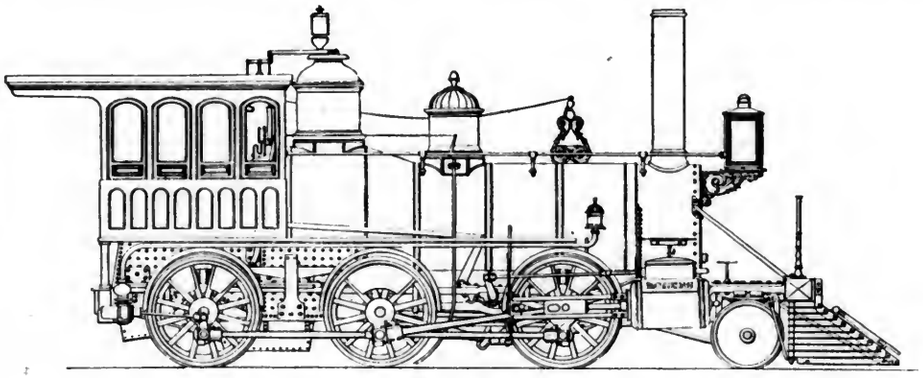


Fig. 26.

both of which will be described in another chapter. With a single axle-truck in front of the cylinder, the front driving-wheels can be placed farther forward than they can be on a ten-wheeled engine with a four-wheeled truck, one axle of which is in front, and another behind the cylinders. Consequently "Mogul" engines have a larger proportion of their weight on the driving-wheels than ten-wheeled engines have, and this has brought the "Moguls" in favor for freight service.

The demand for more powerful locomotives naturally suggested coupling four pairs of wheels, and led to the "consolidation" type, which has eight driving-wheels coupled, and a pony truck in front of the cylinders. In 1880, the first "consolidation" engine built at the Rogers Works was completed.

The types of engines which have been described, are the principal ones which have been evolved in this country for ordinary freight and passenger service. Besides these there has been a demand for locomotives for special service, such as switching, urban and suburban traffic, and for narrow-gauge railroads; the narrowness of which made it essential to design special methods of construction.

The most common plan used for switching-engines is that which has four-coupled wheels, both axles being placed between the furnace and smoke-box. Separate tenders are furnished with locomotives of this kind, or the tanks may be placed on top of the boilers.

When more powerful engines are required, six-coupled wheels are used with the axles, all between the furnace and smoke-box. Some six-coupled engines have been built with an axle behind the fire-box, but with this arrangement the overhanging weight of cylinder, smoke-box, etc., brings an undue amount of weight on the front pair of wheels.

The advantage of locating the driving-axles between the furnace and smoke-box is, that the overhanging weight of the furnace behind balances that of the cylinders, smoke-box, etc., in front, and in this way the driving-wheels carry the whole weight of the engine, and it is equally distributed upon them. Placing the water-tank on top of the boiler is inconvenient and unsightly, and when in that position it is difficult to get room enough for an adequate supply of water, and there is also the disadvantage of a varying load on the driving-wheels, which may be excessive with the tank full, and insufficient when it is empty. For these reasons Mr. Hudson, after he became superintendent of the Rogers Works, turned his attention to devising methods of construction which would retain all the advantages of the arrangement of axles described, but which would at the same time give a longer wheel-base for steadiness, but with sufficient flexibility to enable the engine to run round sharp curves easily. The requirements of suburban and other traffic, in which engines must make short runs, had also created a demand for locomotives which could be conveniently and safely run both ways, and which would not require to be turned around at the end of each journey. Having these objects in view, Mr. Hudson, in 1867, designed and patented the plan of tank locomotive, represented by Plate I, which soon became known as "Hudson's Double-Ender." In this, the two driving-axles were placed between the furnace and smoke-box, and a Bissell truck was placed at each end of the engine. Mr. Hudson's patent was dated May 7th, 1867, and was reissued December 7th, 1875.

It will be seen that the water-tank of these engines was on top of the boiler. This arrangement was open to the objections which have been pointed out. To overcome these Mr. Hudson, in 1872, designed and patented the plan of engine represented by Plate II. In this the arrangement of the driving-axles and the front truck, excepting the equalizing arrangements, are the same as in the

Plate I.

HUDSON'S EIGHT-WHEELED DOUBLE-END LOCOMOTIVE.

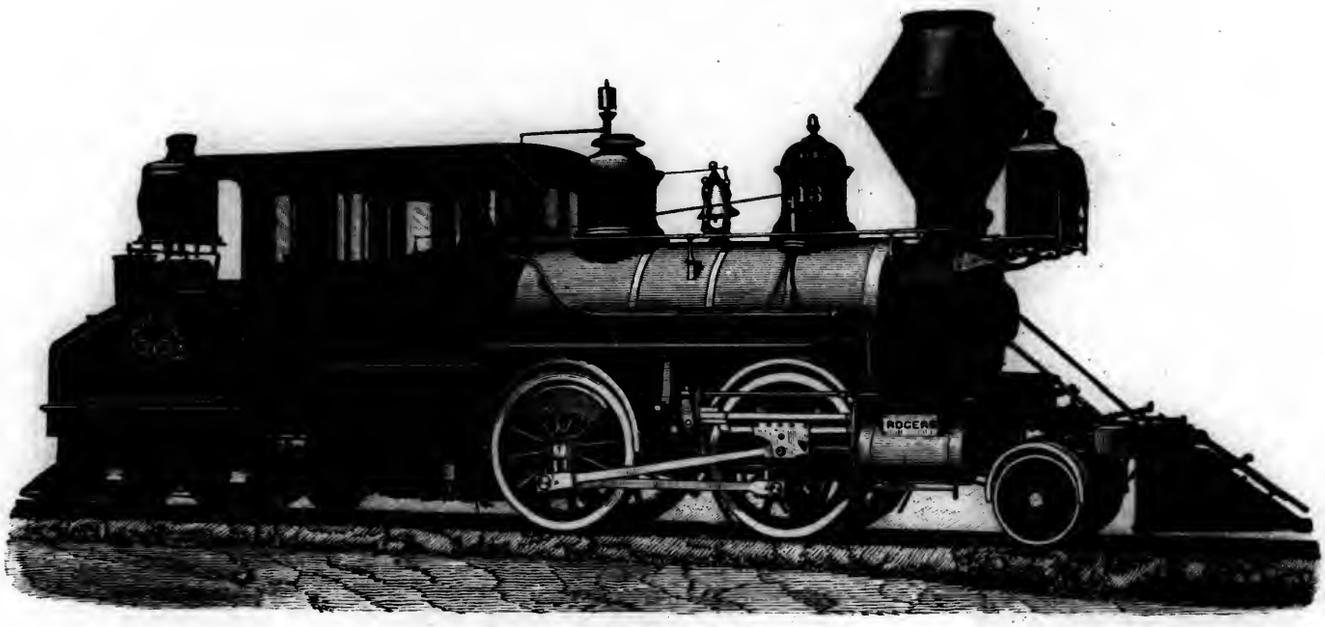


Plate II.

HUDSON'S TEN-WHEELED DOUBLE-END LOCOMOTIVE.

"Double-Ender" plan, but instead of a two-wheeled Bissell truck behind, a four-wheeled swing-motion truck was substituted, and the water-tank instead of being placed on top of the boilers, was placed over the four-wheeled truck. This arrangement was patented July 16th, 1872.

In 1866, Mr. M. N. Forney patented the plan embodied in the engine shown in Plate III. A number of engines of that kind have been built at the Rogers Locomotive Works for various roads. Whether a leading truck is essential for engines of this class has been a subject of a good deal of controversy among railroad engineers. To reconcile the views of the various parties to this dispute, the Rogers Works build locomotives either with or without the leading truck, as required, leaving to the purchaser and user the task of determining whether a leading truck is useful or not.

In 1872, Mr. Hudson took out seven patents for different plans of tank engines with trucks at each end. In all of them his system of equalizing levers between the trucks and driving-wheel springs, which is described in another chapter, was used, and his patents were chiefly for various applications of that system.

He also patented, in 1873, a plan for a compound locomotive. This had two outside cylinders in the usual position, the one being of larger diameter than the other. It was intended that, ordinarily, live steam from the boiler should be admitted to the small cylinder only, from which it exhausted into a super-heater in the smoke-box before it passed into the large cylinder on the opposite side. The steam-pipe was connected with the steam-chest of the large cylinder by another pipe of smaller diameter. Live steam could be admitted by the small pipe to the large cylinder, if required. This plan was never put into practice.

Mr. Hudson's death occurred on the 20th of July, 1881. He was then 72 years old.

The following extracts are taken from an account of his life, which appeared in the *Railroad Gazette* immediately after his death:

"He was born near the town of Derby, England, in 1809, and at an early age began to learn the trade of an engineer and machinist, serving part of his apprenticeship under George Stephenson. In 1833, when 24 years of age, he came to this country, and for a time found work in the engine room and machine shops attached to the Auburn State Prison in New York. He soon left that place, however, and engaged as a locomotive runner on the old Rochester & Auburn Railroad, now a portion of the New York Central. Subsequently he ran an engine on the Attica & Buffalo Railroad, and was made master mechanic of the road, which he left in 1852 to become superintendent of the locomotive works of Rogers, Ketchum & Grosvenor, at Paterson, N. J. In 1856, these works were incorporated as the Rogers Locomotive and Machine Works, and Mr. Hudson was made mechanical engineer and superintendent, a position which he held until his death. He succeeded Mr. Thomas Rogers, who was the founder of these works, and who probably did more than any other man to develop the design and improve the construction of the American locomotive as it is to-day. But Mr. Hudson took up the work where Mr. Rogers left it, and during the 30 years that Mr. Hudson occupied the position of the head of the mechanical department of this establishment, he made many improvements in the locomotives built there, chiefly of a kind which are the result of simplifying details, adopting better methods of putting work together, and making the engines more substantial and more serviceable. He studied, as probably no other locomotive builder did, the performance of the engines he built. He was constantly looking out for their weak points, and it was said by the present head of the establishment, that Mr. Hudson was always more concerned about building a good engine than he was in making a good profit."

(*To be continued.*)

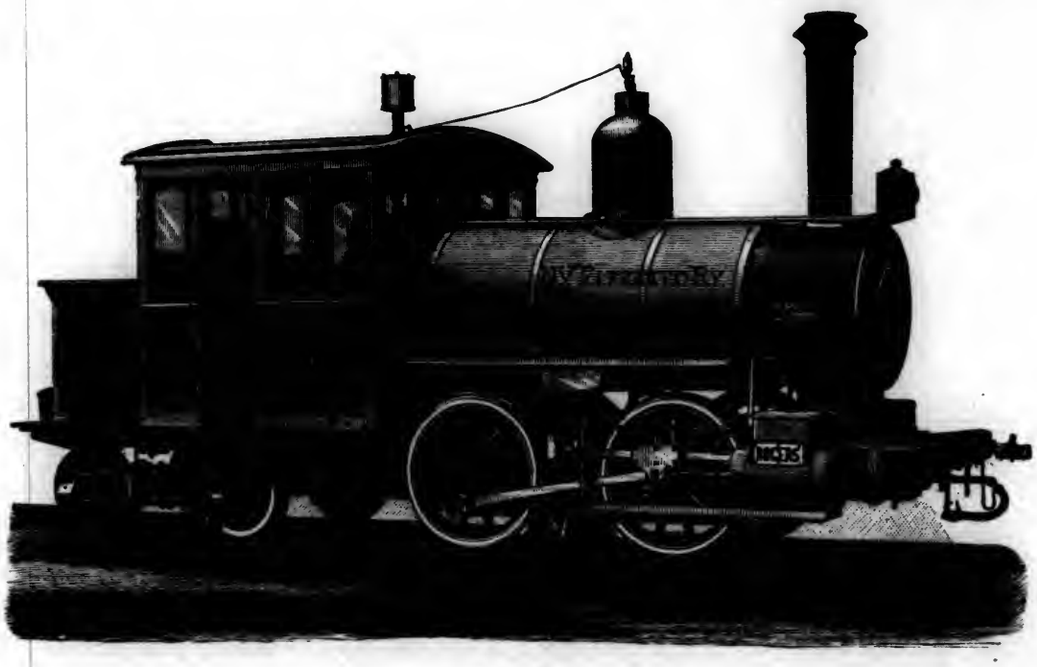


Plate III.

FORNEY LOCOMOTIVE.

A CONSIDERABLE number of engines now building have the Wootten fire-box, which is now to be tried on a large scale on both the Erie and the Baltimore & Ohio. On the latter line it is intended to burn small soft coal, while on the former line the Wootten fire-box is to be used because it is considered the most suitable for anthracite coal, and the latter is considered to annoy the passengers least with dust and cinders. It will, therefore, be seen that the Wootten fire-box is to be tried for distinct reasons in each case.

New Inventions.

Roswell's and Conger's Railway-Signal.

ELISHA R. ROSWELL and GEORGE H. CONGER, of Stratford, Conn., are the inventors of a new and improved form of railway-signal, the construction and operation of which is herewith illustrated and described.

The object of this invention is to improve the manner of operating the signals at railway-stations, which indicate to the engineer of an incoming train the character and time of departure of the train preceding him, and consists in arranging the various signals on the faces of a series of independent drums adapted to be revolved, so that any desired signal may be brought to view by a series of sleeves or hollow shafts, one within the other, to which certain of the drums are attached, so that said drums may be turned independently without disturbing others in the same line.

In the accompanying cuts, Fig. 1 represents a view in perspective of two frames or boxes, each containing a complete set of signals; Fig. 2 represents a front elevation and sectional view of one of the signal-frames; Fig. 3 represents a sectional view through dotted line *x* of Fig. 2; Figs. 4 and 5 represent detail views, and in construction and operation are as follows:

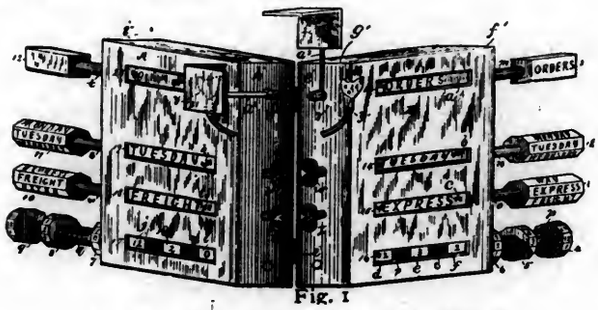


Fig. 1

ROSWELL AND CONGER'S RAILWAY-SIGNAL.

A B are the frames containing the signals; *a b c d e f g h i j k l*, signal-drums within the frames; 1 2 3 4 5 6 7 8 9 10 11 and 12, duplicate drums on the outside of the signal-frames; *m n o p q r s t*, shafts to which said drums are attached; *u v w x*, thumb-nuts on the ends of said shafts *n o r s*; 13 14 15 16 17 18 19 20, openings in the frames through which the signals may be seen; *y y'*, lights; 21 22, shades for same; *b' c'*, sleeves or hollow shafts; C, section of wall.

At railway stations, and situated at one end of the platform, is a set of signals to indicate to the engineer of an incoming train the exact time of departure and also the character of the train preceding him. These signals are slips or tablets of wood having the necessary signals thereon. It requires at least five of these tablets to complete a set, four of which have to be changed for every train. This device is cumbersome, taking up considerable space, besides requiring the attention of an extra man to operate it, and whose duty it is, when the signals are set, to report the same immediately to the telegraph operator. In this device the signals are arranged about the circumference of a cylinder or drum adapted to be revolved. These drums are placed in a frame or box near the depot and operated from the inside, preferably by the telegraph operator.

In Fig. 1 is shown a set of signals consisting of the two frames A B, one an exact counterpart of the other, and hinged at *e' e'*. This matter of hinging will serve to prevent the misplacement of the two sections, enabling them to be placed at the proper angle, so that the signals can be readily seen by the engineers of trains approaching from opposite directions. The drums *a b c g h i*, are rigidly attached to the shafts on which they are placed. These shafts are journaled in the sides *f' g' h' i'*, of the frames A B. The front elevation and sectional view of frame B, as seen in Fig. 2, which is a counterpart of the other frame A, will fully show the construction of the device. The signal-drums may be plain cylinders instead of the many-sided figures, as shown; but it is thought by placing the signals on a flat surface they can be seen more readily.

a is a square drum, having on one of its faces the word "Orders," the other faces being blank; *b*, having sides corresponding to the days of the week and one blank face; *c*, having a sufficient number of sides to represent the character of all trains liable to run over the road, and having one blank face. *d* is a drum whose sides contain figures

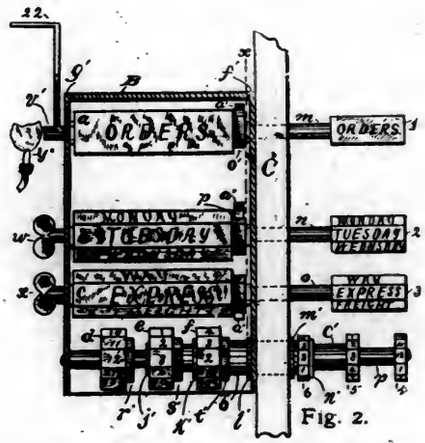


Fig. 2.

ROSWELL AND CONGER'S RAILWAY-SIGNAL.

ranging from 1 to 12, representing the hours, having also one face left blank. *e* is a like drum, containing figures from 0 to 5; *f*, a drum containing figures from 0 to 9. As the drum *d*, would contain thirteen faces, and the drums *e f*, are the same size, so that their faces may be on a line with *d e* and *f*, therefore having a less number of figures and as many sides as *d*, would have sufficient blank space for the purpose, which will hereinafter be more fully described.

The frames containing the signals are placed outside the telegraph operator's office, and the shafts on which the drums are situated project through the wall, as represented by C, and into the office. On the said shafts, within the building, are placed duplicate drums of those on the outside, having on their faces the same characters. Thus, the operator, in setting the signals, will place the drums on the inside as they should appear in the signal-boxes. The drums *d e f*, are placed on the shaft *p*, and hollow shafts or sleeves *c' b'*, a better view of which may be seen at Figs. 4 and 5; Fig. 4 being a sectional view of shaft, sleeves and drums through dotted line *x'* of Fig. 3. The sleeve *c'*, is supported on shaft *p*, turning freely thereon. On one end of said sleeve, and within the signal-box, is placed the drum *e*. On the other end, and

within the office, is the drum 5, the sleeve *b'*, loosely fitting sleeve *c'*, and having on its extreme ends the drums *f* and 6. The collars *j' k' l' m' n'*, serve to keep said sleeves in position and prevent end-play. Turning drum 4, will operate drum *d*, 5 will operate *e*, and 6 will move *f*, so that any one in the line may be turned without disturbing any of the others. This independent movement of said drums is necessary to set the proper combination of figures to denote the hour and minute.

The two frames A and B, form the sides of an angle more or less acute, the point at which they are hinged forming the apex and projecting toward the track. The base of said angle, which is open, will face the station. The signal-frames may be set against the station wall or at any desirable distance therefrom. The angle at which the frames A and B, are placed will depend somewhat on the relative position of the station and track. If the station is situated at a curve on the road, the angle of said frames would be more acute than if the road and station were parallel, the object being to set them in such positions in relation to the track that they may be readily seen by the

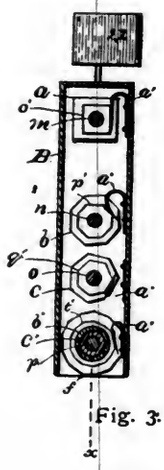


Fig. 3.

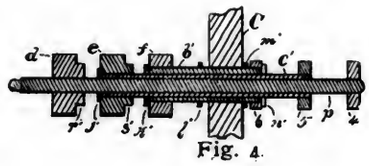


Fig. 4.

ROSWELL AND CONGER'S RAILWAY-SIGNAL.

engineers of trains approaching from opposite directions. For instance, let it be supposed a train is going north, then the face of signal-frame A, is the only one seen by the engineer, and he will observe that the last north-bound train was a freight, and left the station at 12:20. Likewise, the engineer of a south-bound train will see by the signals set in frame B, that the train he is following is an express, and left that station at 12:32. It is of the greatest importance to the engineer about to leave the station to know the character as well as the time of departure of the train he is following. If it is a freight and his a passenger, and the time short between the trains, he will run with extreme caution.

o' p' q' r' s' t', as seen in Figs. 2 and 3, are reduced portions of the drums *a b c d e f*, and having the same number of faces as the main body of the drum. Against these smaller faces the springs *a'*, act and operate as a brake to hold the signals in the position in which they may be placed. The thumb-nuts *u v w x*, on the ends of shafts *n o r s*, and outside of the frames A B, enable the operator to set the signals on said shafts from the outside should he happen to be on the platform when they required changing. At such times the drums *d e f*, having figures thereon, can be manipulated from beneath the box or frame, the same being open at the bottom.

The upper signals—viz., "Orders"—(see Fig. 1) are placed on one of the faces of the rectangular drums *a g*. These are intended as special signals. With this device, when necessary to stop a train for what is in railway parlance termed "Orders," the upper signal *a*, is set in the same manner as the others, and the engineer, knowing that nothing serious has occurred to stop his train, as the customary red flag or light would seem to indicate, continues on, so that the conductor may step from his car into the telegraph office, in place of the usual loss of time consumed by the present system of simply stopping a train by the danger signal, irrespective of the cause. When this signal is not required, the drum is turned and presents one of its blank faces, as seen in frame

Fig. 5.

ROSWELL AND CONGER'S RAILWAY-SIGNAL.

A, Fig. 1. At night lights *y y'*, are used to throw a light on the upper signals. Attached to the ends *v' w'*, of the shafts *m t*, which project through frames A B, are the rods a^2 a^3, supporting the shades 21 and 22. These shades are secured firmly to shafts *m* and *t*. Thus when the drum *g* (see frame A, Fig. 1), is turned so as to present a blank face, the shade 21, by the operation, will be carried down and hide the light. Bringing the signal to view, as shown in frame B, also carries shade 22, up and out of the way, permitting the light to shine fully on said signal. The lights *y y'*, are intended expressly for the upper signals. A separate light, although not shown, will be provided for the signals below. Providing the upper signals with an independent light enables them to be more readily seen by the engineer, and when the signals are removed and the lights obscured it will leave the upper portion of the frame in comparative darkness.

Having brought the shafts through the wall into the office, they are then brought down to the operator's table, making it unnecessary for him to leave his chair to set any desired order or time.

All inquiries and communications should be addressed to Roswell & Conger, No. 19 Burrough street, Bridgeport, Conn., the inventors, who have sole control of the invention.

Lippincott's Siphon Oil-Can.

THOMAS W. LIPPINCOTT, of Rockford, Ill., is the inventor of a new and improved form of siphon oil-can, which is herewith illustrated and described.

In the accompanying cuts, Figure 1 represents a central vertical section of a can and stopper B, and side views of pipes and other devices connected therewith; and Fig. 2, an elevation of the neck of the can and pipes, showing how evaporation of the oil or other liquid is to be prevented when the device is not in use in filling lamp-bowls.

A indicates the can; B, the plug or stopper inserted into the neck of the can, where it is held by friction, it being made of cork or other suitable elastic material, and tapered in form, as shown. C is a tube extending down through the stopper to near the bottom of the can, and extending a short distance above the stopper. F is an-

other tube, extending through the stopper a short distance above and also below the stopper at a slight inclination to tube C, as shown. G is a flexible pipe, of rubber or other suitable material, the upper end of which is sprung over the top end of tube F, while its lower end is provided with a mouth-piece K. D is another flexible tube, of like material, sprung over the upper end of the tube C, and it leads into a lamp-bowl or other vessel E. The tubes C and F, should be made of metal or other material that will resist the action of oil or of any acid liquid that might corrode or destroy them. These tubes should be placed at just such distance apart as to leave sufficient space between them into which the pipes D and G, can be closely compressed, as hereinafter specified. These tubes will be held in their positions in the stopper by the elasticity of its material without other fastening.

The theory of the operation of the device is, that when the can is filled, or partly filled, with any liquid—oil, for instance—and air is forced in upon the liquid by blowing from the mouth—for instance, into pipe K—the liquid will be forced by the air up the tube C, into the pipe D, and thence into the lamp F', and when it has begun to

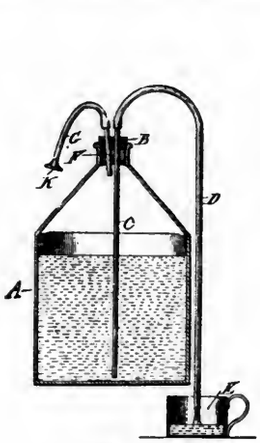


Fig. 1.

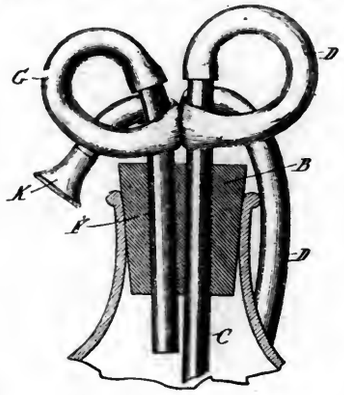


Fig. 2.

LIPPINCOTT'S SIPHON OIL-CAN.

flow it will continue to flow without further compression of the air in the can, provided the lamp-bowl be lower in position than the liquid in the can; but if the lamp be raised while the flowing is going on to a higher position than the surface of the liquid in the can, the current will be reversed and the lamp-bowl emptied into the can again. The tube G, having no valve, then so soon as the liquid is started to flowing, either out of the can into the lamp or out of the lamp into the can, the pipe G, remains open, though it be in a pendant position, as shown in the cuts, and allows free passage of the air both ways. If, however, both pipes D and G, were left open when the device was not in use for the transfer of liquid, the liquid in the can would waste or give offense by evaporation. This is prevented simply and effectually by bending each of the flexible pipes D and G, and placing them between the two tubes C and F, and pressing them down into the space between the tubes, and so compressing the pipes as to prevent the passage of either air or vapor either way, as shown in Fig. 2.

It will be readily seen that the perfect operation of this device is secured without the use of valves, stop-cocks or other complicated parts, and that when not in operation no such parts are needed, evaporation being effectually stopped.

An especially valuable feature of this invention is that it is equally well adapted to any form of receptacle capable of holding oil (or indeed any other liquid), in the mouth or orifice of which the plug or stopper B, can be inserted, and is equally useful with either jug, bottle, demijohn or the ordinary form of can; the stopper B, working as well in a metal screw-threaded throat as in the smooth neck of a jug or demijohn.

It is claimed by the inventor that the device is simple, economical and efficacious, and perfectly adapted to the purpose to which it is applied; while it is far neater and easier of management, as it avoids the usual drip and overflow, thus making it much safer, especially in shops and where many lamps are used, than the ordinary form of can.

Galligan's Feed-Water Heater.

MICHAEL J. GALLIGAN, of Cedar Rapids, Iowa, is the inventor of a new and improved form of feed-water heater, which is herewith illustrated and described.

This invention consists in the application of a feed-water heater to the under side of the fire-box of a steam boiler, and in the construction and arrangement of the connecting-pipes, the object being to use the top of the heater for the bottom of the ash-pit, thus utilizing the heat thereof to raise the temperature of the water beneath, and by the arrangement of the pipes admit of the cleaning out of the heater while the boiler is in operation.

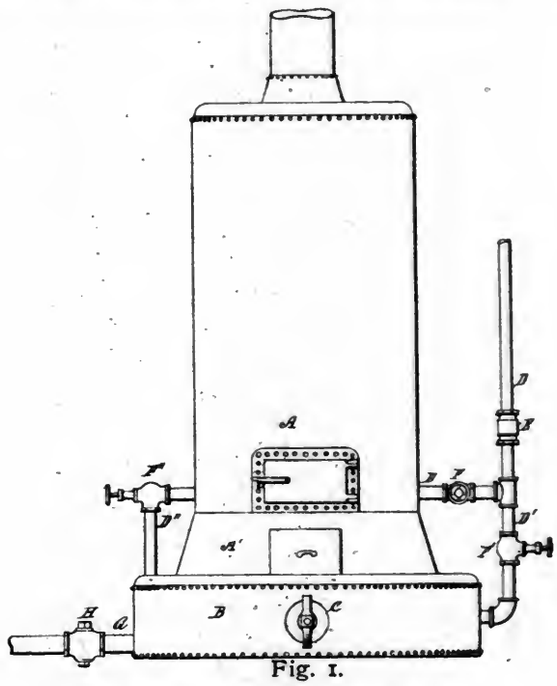


Fig. 1.

GALLIGAN'S FEED-WATER HEATER.

In the accompanying cuts, Figure 1 represents a front elevation of the invention as applied to an upright boiler; and Fig. 2, a vertical section of the same detached.

A indicates the boiler, and A', the fire-box. This boiler may be upright or horizontal, the invention being applicable to either, though, of course, more particularly applicable to such boilers as are provided with an attached

fire-box, and commonly known as "portable boilers," either horizontal or upright. The heater B, consists of a drum, preferably somewhat larger superficially than the bottom of the fire-box, and comparatively shallow, as indicated in the cuts. It is provided with one or more hand-holes C, for convenience of access to the interior in cleaning or otherwise. It is desirable that the whole interior of the heater should be unobstructed, in order that it may be cleaned without difficulty; therefore, stay-rods are dispensed with in the construction of the heater, and to give the two larger sides of the same the necessary resistance to outward pressure they are made concave, as

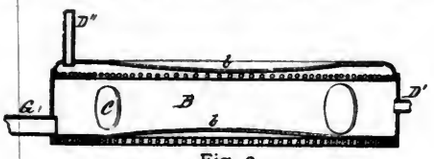


Fig. 2.

GALLIGAN'S FEED-WATER HEATER.

represented in Fig. 2. This not only serves to strengthen the heater, but, in the case of the upper side, forms a considerable receptacle for ashes. A feed-pipe D, communicates directly with the boiler and with the pump or injector. It also communicates directly with a branch pipe D′, passing into the heater. Further connection is made between the heater and the boiler by pipe or pipes D″. The feed-pipe is provided with a suitable check-valve E, and the connecting-pipes with globe-valves F F′ F″, respectively. It will be seen that when the valve F, is open and the others closed the feed-water will flow directly into the boiler, and when this one is closed and the others opened the feed-water will pass through the heater and be warmed by the heat of the fire-box and ashes above it. In general the water will, of course, be conveyed to the boiler in this way; but when it is desired to clean out the heater the feed-water may be injected directly into the boiler, and the heater emptied without stopping the engine or interfering materially with the action of the boiler. For this purpose the heater is provided with a suitable blow-off pipe G, having a gate H. When it is desired to blow out the whole boiler, all of the connections with the heater should be opened, in which case the impact of the steam at various points in the heater tends greatly to facilitate the removal of mud and other impurities collected therein. Thus constructed and applied, the heater forms a natural and suitable base for the boiler, dispensing with any brick-work or other erection for that purpose, and constitutes a part of the ash-pit. The heater thus occupies no extra room, and, being contiguous to the fire-box, receives much of the heat thereof that otherwise would be wasted. Its position is such as to render it the receptacle for all mud and impurities from the water and boiler, and its construction is such as to make the removal of all this easy and expeditious, and without necessarily discontinuing the operation of the boiler.

These feed-water heaters can be either round or square, to suit all kinds of upright or fire-box boilers, and it is claimed for the device that it is simple and durable in construction, and easily handled; while by practical experience it proves admirably adapted to its purpose, giving excellent working results.

The invention is under the control of the inventor, to whom all inquiries and communications should be addressed.

American Railroad Journal.

WHOLE NO. 2,582.] NEW YORK, NOVEMBER, 1886. [VOLUME LX.—No. 8.

RAILWAY COUPLINGS.

BY MR. EDWIN H. A. HEINKE, M.E., LOCOMOTIVE DEPARTMENT, LONDON, CHATHAM & DOVER RAILWAY.*

THE simplest form of coupling, as it has existed for many years, and which is now employed for wagons, is that which takes the form of several links, generally three, or five, or seven, 1 inch to 1½ inch section, and from 4 inch to 12 inch long, inside; these are dropped by hand over the draw-hooks as the wagons come together. This style of coupling, when there is a good deal of slack to be taken up, would, as one could easily imagine, cause a great amount of discomfort to passengers, on account of the shocks and jerks which it would subject them to when the train was starting or pulling up. To do away with this jolting and jerking, the screw coupling was introduced on the London & Northwestern Railway, by an inspector and shunter at Rugby station, about twenty-five years ago, and as a mechanical contrivance adapted for this purpose, it is hard to say where it can be improved upon. It consists of a shackle that is passed through the draw-hook, and a second shackle that is dropped over the next hook; connecting these two shackles is a bar, one-half of which is screwed with a right-hand thread passing through a nut between the jaws of one shackle, and the other half screwed with a left-hand thread passing through a nut in the other shackle; a bar weighted at the end is connected to the center of the screwed spindle, and, by turning this bar round, after coupling, the vehicles are kept with their buffers well up against each other, as the shackles are drawn in till they are in a straight line by the action of the double and opposite screws. The carriages are thus kept well together, their only movement being due to the compression of the buffer springs, the jerking motion thus being reduced to a minimum, or entirely obviated. This is a great improvement on the old system of coupling carriages, which was to back them against a dead buffer stop, and then run an engine against them at a slow speed; the links were held ready, and, as the buffers compressed, were dropped over the hooks, so that when the pressure was taken off the couplings were taut. This was a primitive and rough way of doing things, exceedingly uncomfortable for passengers, and also very detrimental to the rolling-stock, as the speed was not always regulated to a nicety, and the frequent occurrence of these shocks would naturally tend to shorten the life of the vehicles. The slack in the links for goods and mineral traffic is not of so much importance, though, no doubt, brittle goods stand a very great chance of getting broken, if the engine-driver is not very careful in starting, and feeling the weight of his train gradually; and that many links, and not a few draw-bars, owe their retirement from active life to the tremendous strain that is suddenly put upon them by the violent jerks they are so often subject to in taking up the slack, as to the inferiority of the iron. An alteration, which the author believes is not an improvement, has been made by making the last link, which is connected to the draw-hook, with jaws at one end and attaching it to the draw-bar by a pin and cotter, instead of welding the link up; in practice, the enormous strain that the couplings are liable to tends to lengthen them, the jaws then nip on to the draw-hook and the links stand straight out, which is objectionable on several grounds.

The ideal coupling that is required is one that is cheap; this is most essential; and must be easily and universally applicable to all classes of wagons of various companies, and able to couple up to all kinds of hooks, so that a foreign wagon can go into a home yard and be worked in without difficulty. This last may appear a simple matter, but those who are connected with a railway know what a variety of sizes and patterns of hooks can come into a yard in a day.

It ought to couple up to any wagon that is not fitted with a similar apparatus, without reverting to the present or old system of going between the buffers; it ought to couple up quickly under all conditions, such as on a curve, when the buffers are compressed, as they may be on live-stock, and when the buffers are different height from rail, due to load; and last, and almost one of the most important of the conditions, is, that it must be made to suit different lengths of buffer-head from headstock, and the different distances between the hooks of two wagons. It may seem curious, but it is a fact, that the author has seen the front edge of draw-hooks knocked up, showing that another hook has actually run into it. This would occur only with transverse, laminated buffing springs; but, as there are a good many of this class of wagon running, it would have to receive attention, and it shows how little room there is in some cases to arrange any mechanism. To stand any chance of being adopted or applied within a measurable distance of time, it ought not to interfere very much with existing arrangements, so that it could be introduced gradually. So, when we come to consider all these varied conditions, the enormous and sudden strains that wagon couplings are liable to, and which are enough to put the strongest mechanism that can reasonably be added, out of order in a moment and render it unworkable, besides which it is exposed to all weathers, the deteriorating action of dirt and rust, and the little or no attention that is bestowed upon it to keep it in order, it will easily be perceived that it is a very difficult matter to get hold of a really good coupling.

Having now given some idea of what an ideal coupling should be, and the difficulties it has to contend with, we will proceed to see why it is required. The chief reason is for the prevention of accidents, loss of life, and the re-

* Abstract of paper read before Balloon Society.

duction of risks generally to the men employed in railway work, principally goods guards and shunters. The percentage of death and injury among this class of men being very high, higher than any other class; for the year 1884 it was 1 in 17 injured, and 1 in 139 killed. Now, this is why the question is a public and leading one, and we must admit that it is a very serious state of affairs, and one that naturally calls for some improvement; and as the work is particularly laborious, it ought to be, as much as possible, devoid of danger; the danger consisting in the necessity of the men having to go under and between the buffers in order to couple.

Another reason is the saving of time, as an automatic coupling which has an instantaneous movement would not take more than two seconds, and the author doubts whether a man could get under, couple, and out again under six seconds; so, according to that, two-thirds of the time is saved, which is an advantage; but the saving of labor is a far greater one, for he knows by actual experience how hard the work is; so, what with running up and down the length of trucks, stooping low to get under the buffers, then lifting heavy links up and dropping them over the next hook, getting out again, then shouting and whistling, and doing all this, perhaps, on a bitterly cold, dark night, in a blinding storm of rain or snow, it can be imagined that a goods guard or shunter's life is not a happy one.

Why won't the different railways do anything in the matter? The answer is not difficult to seek, and is simply the question, "What return shall we get for our outlay? We are not a benevolent institution, but a company intrusted with other people's money, who rely on us to return them the best interest we can. If we lay out, say, £2 on each wagon we possess, on the total number that will represent an immense sum; roundly, more than three-quarters of a million. What shall we gain by it? A saving of life?—certainly. A saving of time?—perhaps. Now, lives don't cost us anything, and the time saved is not of much value, as a small portion only is saved each journey, and the trucks would, therefore, be waiting at either end instead of on the journey, the engine probably being in steam about the same length of time in each case. Now, we are only officials, and if the shareholders should disapprove of the outlay, and perhaps reduction of dividend, we should get into trouble."

Mr. Heinke holds that what is called the non-automatic system is the best; his reasons are these: In the first place, if an automatically fitted wagon comes next to a non-fitted, it is useless as regards the coupling process, which has then to be effected by going underneath and coupling in the old style. Secondly, the basis of all automatic couplings is a rigid projection on one wagon sliding up a similar rigid projection on the opposite one. Now, a rigid projection in front of the hook is objectionable and dangerous, not so much on what is called dead buffer stock, because the distance between two wagons is fixed and unalterable; but with live or spring buffers the case is very different, as the strokes vary so much, ranging from 10½ inches to 3½ inches, or even less when the wagons have been on the road some time and the springs are worn. The difficulty of arranging the mechanism that will suit these different lengths is easily understood, and though everything may be nice and comfortable when the buffers of the wagon are just touching, it is a different matter when they collapse, and as this distance varies from 7 inches to 21 inches, something will in all probability foul, unless, of course, special arrangement is made for special cases; but that is not of much use, as wagons are continually being changed as regards their relative position to each other, and it is as likely as not for one to get another next to it that will render the arrangement useless, although fitted in the same way. It is then that this rigid projection becomes dangerous, as the man must, in that case, go underneath to couple. Another point is that, although automatic couplings couple automatically, they cannot, of course, uncouple in the same way; having, therefore, to be uncoupled by hand, they do not do away with the necessity of a man to attend to them, and he ought in either case to be on the spot, to make sure that the coupling has been properly performed, and that those wagons that are not required are out of gear; for, if they were in gear, the shock of the engine running back on a line of trucks would probably couple up more than was wanted, the driver would go off with the wrong ones, and much delay and inconvenience would be caused. Now, with the non-automatic couplings this could not happen. The man would have to perform the coupling operation as he does now, only without danger to himself, more quickly, and with less fatigue; but, doing it himself, he would be quite sure it was properly done.

The author has given the subject of coupling a good deal of attention lately, and the result is, that he has produced one. Through the kindness of Mr. Kirtley, two wagons have been fitted with it, and are running on the London, Chatham & Dover Railway. The principle of the coupling is that, by means of a handle on the outside of the wagon, a single and instantaneous movement effects either the coupling or uncoupling, by means of the lifter, and is worked by one hand. This raises the suspension-link in a slanting direction to a horizontal position, and clear of the opposite hook when the buffers are touching. At the moment this takes place, the auxiliary links, which are connected to the coupling-link and to the cross-shaft, come into play and turn the coupling-link on the center or joint between the suspension and coupling-link, and tilt it over the draw-hook on the opposite wagon; it is now coupled.

In one arrangement shown, the handle can then be swung back and out of the way, the lifter being divided for that purpose; to uncouple, raise the lifter smartly by means of the handle again, the coupling-link is raised clear out of the hook, and, being balanced, drops back again into the normal and vertical position under the hook, out of the way, and clear of everything. If anything goes wrong with the mechanism, the pins can be knocked out and it can be coupled by hand in the ordinary way, not being much heavier than the links now in use. In the sudden and rough stoppages that often occur in goods trains, the sudden reduction of distance between the wagons, due to the compression of the spring buffers, is taken up in the joint between the suspension and coupling-link, so there is no liability of parts fouling, or damage occurring to headstocks or ends of wagons. The auxiliary links, on which there is no strain at all in the ordinary way, would, in the event of the suspension-link breaking, form a safety-chain. For coupling on curves the top of

the coupling-link is widened. The whole of the lifting arrangement, brackets, cross-shaft, handle and lifters, go up together bolted to the headstock, and, if Gedge's hook is used, the suspension-link can be dropped in and the whole arrangement is applied in a very short time, and at a moderate cost, as there is no fitting required; the parts being forgings in the rough, all the machining that is required is the drilling of the holes. Another point is that, in this arrangement, you can feel by the weight on the handle whether the trucks are coupled or not, without looking, or if unable to see on account of the darkness. In reference to the cradle-coupling system, it has many good points, one being absence of any attachments to the links, thus leaving them free after the coupling has been effected; though, on the other hand, on a dark night there would probably be some difficulty in getting the links set properly in the cradle before lifting them up to couple.

Then there is the pole coupler. Opinions appear to differ very much on the point of its utility and convenience; but there is no doubt about one thing, and that is its cheapness. I have seen it at work, and the coupling can be done quickly by those who have practiced with it; but it requires two hands, and light; the pole has to be carried about, which is objected to very much, as the shunter has already his flags or lamp to carry, as the case may be; and I have heard that the men have often thrown down the pole and have coupled by hand.

The adoption of a mechanical coupler is a serious matter for a railway company to consider, the Northeastern alone having over 75,000 wagons, the other companies possessing varying numbers, according to the size of the line, going down as low as 516 on the North London Railway. The total number of wagons in the United Kingdom is nearly half a million, so that what is called a non-automatic system is the best, and the most likely to be adopted, as, generally speaking, it involves less expense, and meets more of the conditions which are so numerous and that have to be studied on a railway.

ENGLISH AND AMERICAN LOCOMOTIVES.

No. II.

(*From the Mechanical World.*)

In American locomotives the boiler presents several features of novelty to the eye of the English locomotive-boiler maker. One of the first details of construction which will strike him as peculiar is the method of attachment of the front tube plate. The English method is to attach the tube plate to the barrel of the boiler by means of an angle-iron ring, as shown in Fig. 1, the tube plate being flanged forward for the attachment of the smoke-box plate. In American practice the boiler barrel does not stop just short of the tube plate as in an English engine, but continues right on past the plate, and in reality forms a portion of the smoke-box. The tube plate is quite distinct from the smoke-box, and is simply a circular plate with edge flanged forward, of a diameter equal to the inside diameter of the front barrel ring within which it is riveted, as in Fig. 2.

A front tube plate is therefore removable without disturbance of the smoke-box connections. The dome connection is made by flanging outwardly the base of the dome, and riveting it through the edge of the boiler crown and through the horizontal flange of a strengthening ring, the vertical flange of which, in turn, is riveted through the base of the dome above the flange. A very strong connection is thus formed. Another plan which the writer has found in boilers made at the Baldwin Locomotive Works, is that shown by the sketch, Fig. 3. Here the

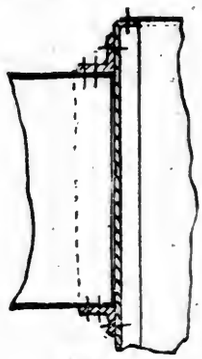


Fig. 1.

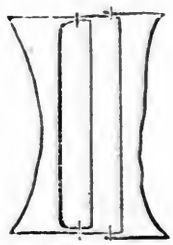


Fig. 2.

dome is flanged outwardly and riveted through the boiler-crown plate, which in turn is flanged upwards and riveted to the dome, a neat and strong connection resulting. The Baldwin fire-door, Fig. 4, also is similarly flanged, no solid ring being employed and the rivet-heads are not exposed to the fire. The fire-box of an American engine, too, presents points of diversity in that it is made from steel and frequent-

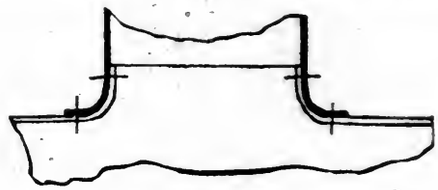


Fig. 3.

ly corrugated, the stud-stays being of iron, not of copper. Frequently, the form and method of flanging of the plates closely or exactly resembles those to which we are here accustomed, but the tube plate is often a distinct piece from the rest of the fire-box, being, like the front tube plate, a plain, flanged plate riveted about 5 inches forward

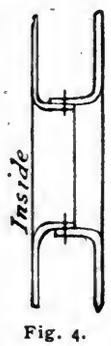


Fig. 4.

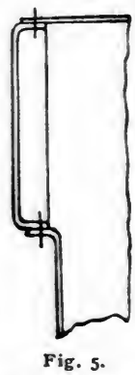


Fig. 5.

of the lower fire-box plate to which, and to the fire-box crown, it is flanged and riveted, as in Fig. 5.

The dome crown is customarily of cast-iron, and to it is attached the regulator apparatus, the valve of which is of the double-beat description of cast-iron and approximately in equilibrium, Fig. 6. With such a valve the difficulty of handling a regulator lever is minimized. The regulator lever is horizontal and draws backwards and forwards, to

and from the back fire-box-casing plate. The tubes, in place of brass, are of iron, and cast-iron is used for the smoke-box door, funnel base-piece, exhaust-pipe in smoke-box, as well as for dome crown, as mentioned above. The staying of the fire-box top differs from our own practice in that the girder stays extend across the box not longitudinally. These are of wrought-iron, placed in pairs wide enough apart to admit of the suspension bolts passing

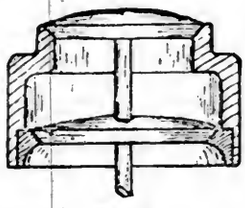


Fig. 6.

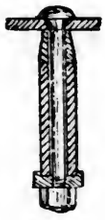


Fig. 7.

between. They are held together at the top by plate-washers, with turned-down edges upon each bolt, and the bolts occur about every 4½ inches, and are nutted up inside the box by thin nuts, or by riveting over with a taper neck to the bolt, which serves to form a tight joint in the crown-plate, Fig. 7. The girders are held off from the crown-plates by distance pieces of cast-iron. Otherwise the general form of boiler does not differ from the English type, unless it be in the standard passenger locomotive,

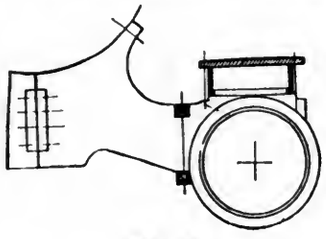


Fig. 8.

the boiler of which has, a sloping junction-piece between the barrel and the fire-box crown. This coned portion gives a very distinctive appearance to an American engine, and is, in fact, quite a feature in the general impression they convey to the eye of a stranger.

The cylinder is a notable feature in an American locomotive. This is universally of the outside type, and is placed horizontally. Each cylinder is cast with a large side bracket, and the two castings are united by bolts

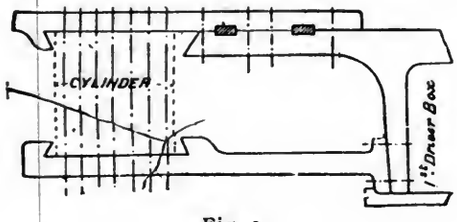


Fig. 9.

under the center of the smoke-box, as shown in Fig. 8. The two wings or brackets thus united form, therefore, a seat for the smoke-box. The valve-chest is not cast with the cylinder, and the working face stands above any portion of the cylinder, and is, therefore, perfectly accessible to the tool of the planer. The valve-chest is formed simply by placing a square frame of cast-iron, about five inches deep, surrounding the ports on the cylinder face. A flat cover placed over this completes the chest, which is united to the cylinder by bolts, which pass through the chest cover outside the chest-ring itself and into the body of the cylinder, which is about one inch below the valve seating. By removing the nuts of these studs, not only is the chest cover removable, but the whole valve-chest also, with valve and spindle. An enormous saving of time is thus effected, and the accessibility secured is a very serious and important item in hot climates, where men will not, or cannot, do efficient work doubled up under a hot engine with inside chests. In the American engine the valve is as accessible almost as the regulator handle. The cylinders are attached to the bars of the framing by long, vertical through bolts and horizontal keys, and the annexed sketch, Fig. 9, will serve to show how this is accomplished. The cylinder is held between two bars of the frame, the lower one of which projects from the lower end of the nearest axle-fork, and the upper one of which is a separate bar bolted to the projecting upper member of the frame. It is easy to see from this that the total removal of the cylinders can be readily and speedily effected by removing these bars. This method of cylinder attachment is employed for large and powerful engines, as it is convenient in regard to the construction of the frame for wheels of small diameter; but in lighter engines of the passenger type, the framing, forward of the leading driver, is of a single bar only, attached to the cylinder castings at the level of the center line of the cylinder, by bolts passing transversely through the frame-bar and a projecting flange beneath the casting. The arrangement of cylinders horizontally, admits of such a symmetrical construction that both cylinders may be and are cast from one pattern, and finished irrespective of which side of the engine they may be finally placed.

Turning to the valve-motion, we find that the slide-valve is always upon the top of the cylinder, as shown in our Fig. 8, within a chest formed of a four-sided ring with rounded corners and a cover-plate. The joint between the chest cover and chest ring, as well as between the chest ring and cylinder face, is made by means of a ring of thick copper wire let into a groove tooled in the edges of the chest ring, and brazed to an even thickness at the joint of the wire. The valve itself is of cast-iron, so dispensing with the expensive gun-metal which, contrary to stationary practice, forms the material used by our own locomotive builders, though it is well known that cast-iron is so eminently satisfactory. The valve spindle works through a stuffing-box at the back end of the chest, no front box or blind gland being necessary. The spindle, which is forged solid with the valve buckle, is cottered outside the chest in a parallel socket at the end of the valve-rod, which is jointed at its other extremity to the head of a lever standing vertically from the rocking-shaft, which also carries on another hanging lever the link-block, and no allowance is made in the valve spindle and rod for the versed sine of the arc described, this small amount being considered as sufficiently allowed in the length of the valve-rod, which is very great.

The link-blocks, therefore, being connected to the hanging lever of the rocking-shaft, have a motion opposite to the valve, and the versed sine of the arc described by the link-block center is pretty well counteracted and balanced by the versed sine described by the suspended point of the link, which is hung from the "weight" shaft above,

the "weight" shaft being so, however, in name only, for in place of the cumbrous balance weight to which we are accustomed, the link-motion is balanced by a coiled spring in a neat box on the "weight" shaft, which spring is adjustable to exactly balance that portion of the weight of the gearing which comes upon it.

The links themselves are built up in sections, bolted together at each end where attached to the eccentric rods, and the eccentric rods are attached to cast-iron straps in two pieces, encircling eccentrics also made in halves, the larger half of cast and the smaller often of wrought-iron. Wrought-iron working parts are all properly casehardened.

From the foregoing it will appear that there is nothing in American locomotive practice differing greatly from the modern practice of our own stationary-engine builders. It is not many years since gun-metal slide-valves were common enough, or since eccentric straps were of the same metal or of wrought-iron. All this has pretty well disappeared, and we only find cast-iron employed, with safety and economy; but in locomotive practice we have adhered to the older rule, and, therefore, have been unable to reduce the cost of locomotives in the same ratio as first-class stationary engines. In America, both classes of work have run in parallel grooves, with corresponding advantage to the locomotive builder. It would have been impossible to convey in so few words a description of English locomotives, which should as accurately describe general features as have sufficed in our brief description of the American engine. What we have said applies not only very largely to both goods and passenger engines, but also to the builds of different makers. In the one item of cylinders alone, whilst the whole of the American practice is combined in the words: outside, horizontal with top valve chests—English practice is ranging all over the field, and includes every feasible inclination either up or down, inside or outside, with valve chests anywhere. To pull a train of 150 tons on the Midland Railway requires something very similar but still different from what is required on the Lancashire & Yorkshire, or the North British. The Manchester, Sheffield and Lincolnshire again differ in slight particulars. The London & Northwestern, and Great Northern differ again, and for their own traffic will use two different engines for the same train on different days. We have no uniformity in a country wherein no place is 1,000 miles from any other, and climate and general contour of country are equal. In America, over a territory vastly greater in distances and variations of climate, no such wide discrepancies of practice appear, and comparatively few classes cover the range of requirements. For main-line work they have the four-coupled passenger engine of the "American" type, for heavier traffic the six-coupled "Mogul" type, and for heavy freight work the "Consolidation," or eight wheels-coupled engine. American locomotives have been usually very poorly supplied in the matter of the foot plates. Very poor apologies for these are to be found, a mere shelf attached to the side of the boiler barrel being all that exists. Now, however, we are informed that more substantial plates are fitted, so as to render the duties of the engineer much safer than they have been. In this respect American builders may well take a lesson from English practice, which embodies foot-plates of great width.

OFFICE OF THE SECRETARY OF

THE MASTER CAR-BUILDERS' ASSOCIATION.

23 MURRAY STREET, NEW YORK.

October 15th, 1886.

ANNOUNCEMENT OF THE RESULTS OF LETTER BALLOTS.

The following are the results of the voting by letter ballot on the questions submitted to the members by a circular, dated August 10th, 1886:

On the first question—"Are you in favor of the adoption, as a standard, of the dimensions and form of double dead-blocks, described and illustrated under heading I, Figs. 1–3?" (see next page)—there were 381 affirmative and 119 negative votes cast. As two-thirds of all the votes cast are required for the adoption of a standard, and as the proposed "dimensions and form of double dead-blocks" received more than that proportion, *they have been adopted as standards of the Master Car-Builders' Association.*

On the second question—"Are you in favor of the adoption, as a standard, of the dimensions of beams for double dead-blocks described and illustrated under heading II, Figs. 4 and 5?"—there were 375 affirmative and 126 negative votes cast. The proposed "dimensions of beams for double dead-blocks" *have, therefore, been adopted as standards.*

On the third question—"Are you in favor of the adoption of 34½ inches from the level of the top of the rail to the center of the hook, as the standard height for the draw-bars of passenger cars?"—there were 246 affirmative and 276 negative votes cast. As the proposed height of draw-bars for passenger cars did not receive two-thirds of the votes cast, it is *not adopted as a standard.*

On the fourth question—"Are you in favor of the adoption, as a standard, of the form of tread and flange for car-wheels, represented by the engraving under heading IV, Fig. 6?"—there were 411 affirmative and 91 negative votes cast. The proposed form of tread and flange, therefore, *has been adopted as a standard.*

On the fifth question—"Are you in favor of the adoption, as a standard, of the 'Christie' brake-shoe?"—there were 369 affirmative and 130 negative votes cast. The "Christie" brake-shoe, therefore, *has been adopted as a standard.*

ACTION OF THE EXECUTIVE COMMITTEE OF THE MASTER CAR-BUILDERS' ASSOCIATION, AT A MEETING HELD IN NEW-YORK, SEPT. 16, 1886.

AUTOMATIC COUPLERS.

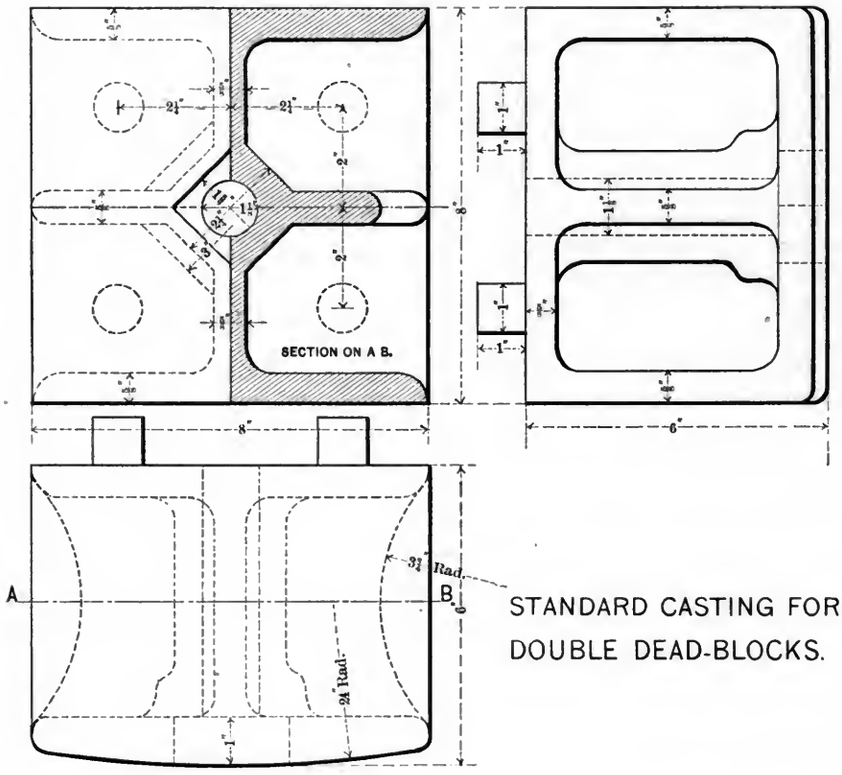
The following resolution was adopted by the committee, "That hereafter the executive committee will not examine into the merits of any car-coupler unless it has been put into practical use, and the inventor of it, or the owners of the patents, sign a written statement that they believe it to be as near perfect as they know how to make it, and then get five members of the association to certify that they believe the coupler is a practicable one, with a recommendation that the executive committee investigate its merits."

WHEEL-DEFECT GAUGE.

A resolution was adopted recommending "that, at the next convention of the association, the radius of the curve

FIG. 1.

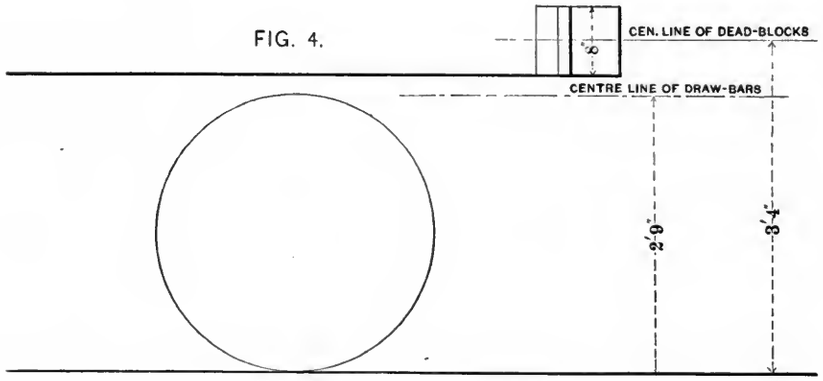
FIG. 2.



STANDARD CASTING FOR DOUBLE DEAD-BLOCKS.

FIG. 3.

FIG. 4.



STANDARD DIMENSIONS FOR DOUBLE DEAD-BLOCKS.

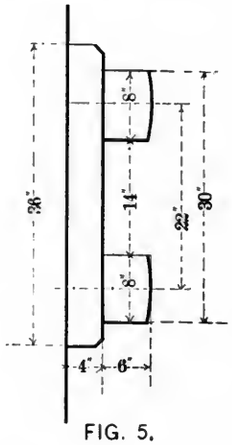


FIG. 5.

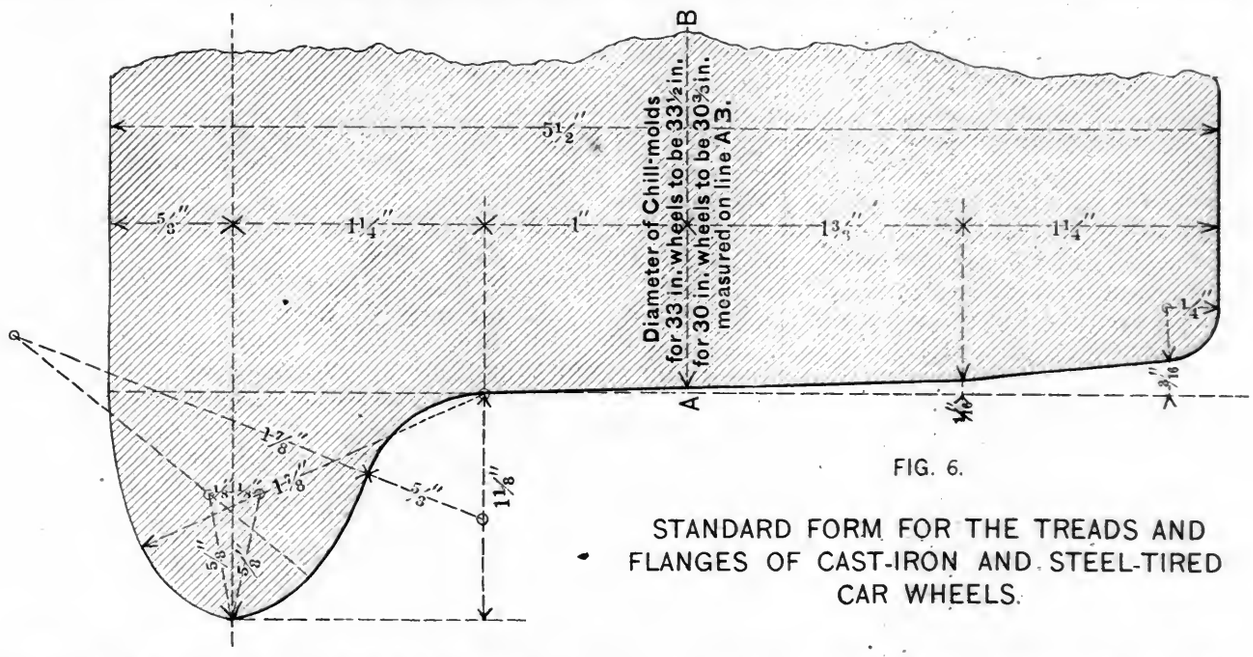


FIG. 6.

STANDARD FORM FOR THE TREADS AND FLANGES OF CAST-IRON AND STEEL-TIRED CAR WHEELS.

for the throat of the flange of the wheel-defect gauge should be made $\frac{3}{16}$ in. instead of $\frac{5}{8}$ in., and the committee also recommended that railroad companies make this change now."

The following engraving, Fig. 7, represents the gauge with the proposed change.

BRAKE TRIAL FUND.

The secretary reported that he had received $25.00 from each of the following companies to defray the expenses of the brake trials made at Burlington, Iowa:

Theo. N. Ely, Pennsylvania Railroad	$25.00
Boston & Albany Railroad Company	25.00
Atchison, Topeka & Santa Fé Railroad Company	25.00
Chicago, Milwaukee & St. Paul Railroad Company	25.00
Northern Pacific Railroad Company	25.00
Louisville & Nashville Railroad Company	25.00
Chicago & Northwestern Railroad Company	25.00
Cleveland, Col., Cin. & Ind. Railroad Company	25.00
Illinois Central Railroad Company	25.00
New York, Lake Erie & Western Railroad Company	25.00
Pittsburgh, Cincinnati & St. Louis Railroad Co	25.00
Grand Trunk Railway Company	25.00
Baltimore & Ohio Railroad Company	25.00
Union Pacific Railroad Company	25.00
Total	$350.00

A resolution was adopted instructing the sub-committee, which was appointed at Niagara Falls, to raise funds to defray the expense of the brake trials, and to solicit railroad companies to contribute the money required, which is $500.00, to publish the brake committee's report.

AMENDMENTS TO THE RULES OF INTERCHANGE.

The secretary was instructed to send a circular to the members of the association, requesting them to suggest to the executive committee any amendments or changes to the rule of interchange which the members may think are required.

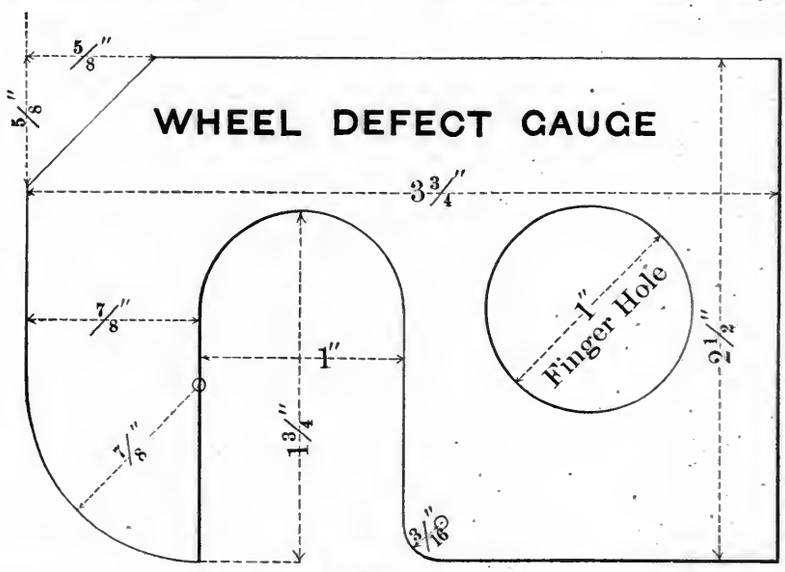


FIG. 7.

HARDENING MILD STEEL:—A writer in *Engineering* calls attention to the fact, which, he says, is not so generally known among engineers as it might be, that even the very soft steel plates now used for boilers, etc., can be hardened by quenching to a very great extent. Reports of a large number of experiments are given to prove this fact.

LIST OF SUBJECTS,

WITH THE COMMITTEES APPOINTED TO REPORT THEREON AT THE ANNUAL CONVENTION OF THE MASTER CAR-BUILDERS' ASSOCIATION, TO BE HELD IN MINNEAPOLIS, JUNE 14th, 1887.

1. Standards and Appliances for the Safety of Trainmen:

In 1884, the committee on this subject was appointed in accordance with the following resolution: "*Resolved*, That a committee be appointed to prepare a circular calling the attention of railroad managers to the standards and the appliances for the safety of trainmen, which have been recommended by this association, and that this committee be urged to do everything in its power to secure their adoption." At the convention held in 1885, the committee was discharged, and a resolution was passed to have a new one appointed. This committee was continued in 1886.

H. Hegewisch, United States Rolling-Stock Company, No. 35 Wall street, New York.

John Kirby, Lake Shore & Michigan Southern, Cleveland, O.

M. N. Forney, No. 23 Murray street, New York.

2. British and Continental Practice in Matters of Interest to the Master Car-Builders' Association:

R. H. Soule, New York, Lake Erie & Western, Buffalo, N. Y.

Wm. McWood, Grand Trunk, Montreal, Canada.

Henry A. Whitney, Intercolonial, Moncton, N. B.

3. Automatic Freight-Car Brakes:

Godfrey W. Rhodes, Chicago, Burlington & Quincy, Aurora, Ill.

Geo. Hackney, Atchison, Topeka & Santa Fé, Topeka, Kan.

B. Welch, Central Pacific, Sacramento, Cal.

John S. Lentz, Pennsylvania & New York Canal & Railroad Company, Packerton, Pa.

W. T. Hildrup, Harrisburg Car Co., Harrisburg, Pa.

4. The Comparative Advantages of the Two Methods of Constructing Freight-Cars, with and without Platform Timbers or End Sills projecting from the End of the Car:

This committee was continued, its scope enlarged, and it was empowered to submit plans giving two standards for the end floor-framing of freight-cars.

E. B. Wall, Pittsburgh, Cincinnati & St. Louis, Columbus, Ohio.

B. K. Verbryck, Chicago, Rock Island & Pacific, Chicago, Ill.

Geo. W. Cushing, Northern Pacific, St. Paul, Minn.

W. H. Harrison, Baltimore & Ohio, Baltimore, Md.

W. F. Turreff, Cleveland, Col., Cinn. & Ind., Cleveland, O.

5. Maximum Outside Dimensions of Freight-Cars:

John P. Levan, Pennsylvania Railroad, Altoona, Pa.

C. A. Smith, Union Tank Line, 267 Fourth street, Jersey City, N. J.

Geo. C. Watrous, Detroit, Lansing & Northern Railroad, Ionia, Mich.

6. Standard Draw-Gear for Non-Automatic Couplers:

S. B. Haupt, Norfork & Western Railroad, Roanoke, Va.

J. N. Mileham, New York, Lake Erie & Western Railroad, 234 Third street, Jersey City, N. J.

Allen Cooke, Chicago & Eastern Illinois Railroad, Danville, Ill.

7. Appliances to Prevent the Slipping of Wheels, both Passenger and Freight:

J. W. Marden, Fitchburg Railroad, Boston, Mass.

F M. Wallis, Philadelphia, Wilmington & Baltimore, Philadelphia, Pa.

W. H. Day, Wilmington, Columbus & Augusta Railroad, Florence, S. C.

8. Standard Freight-Car Truck and Axle for Cars of 60,000 lbs., Capacity:

This committee is instructed to suggest means for having the axles made uniform in size.

Joseph Wood, Pennsylvania Company, Fort Wayne, Ind.

H. Roberts, Chicago, Grand Trunk & Detroit, and Detroit, Grand Haven & Milwaukee, Detroit, Mich.

M. M. Martin, Wabash, St. Louis & Pacific, Decatur, Ill.

Leander Garey, Hartsdale, Westchester Co., N. Y.

R. C. Blackall, Delaware & Hudson Canal Co., Albany, N. Y.

9. Standard Sizes of Lumber for Freight-Cars:

Wm. Forsyth, Chicago, Burlington & Quincy Railroad, Aurora, Ill.

Frank J. Hecker, Peninsular Car Works, Detroit, Mich.

W. R. Davenport, Erie Car Works, Erie, Pa.

10. The best Form and Construction of Car-Roofs:

J. D. McIlwain, Grand Trunk Railway (Great Western Division), London, Ont.

Samuel Irwin, Missouri Pacific Railroad, Sedalia, Mo.

L. Packard, New York Central & Hudson River Railroad, West Albany, N. Y.

11. Subjects to be Reported at the Next Annual Convention for Investigation and Discussion at the Succeeding Convention:

J. W. Marden, Fitchburg Railroad, Boston, Mass.

John W. Cloud, Pennsylvania Railroad, Altoona, Pa.

Thomas A. Bissell, New York Central Sleeping Car Co., Buffalo, N. Y.

12. Committee of Arrangements for the Next Annual Convention:

Geo. W. Cushing, Northern Pacific Railroad, St. Paul, Minn.

Geo. F. Wilson, Minneapolis & St. Louis Railroad, Minneapolis, Minn.

Final Report of Wheel-Gauge Committee, at Meeting Held at National Hotel, Washington, D. C., July 14th, 1886.

COL. H. S. HAINES, *Chairman of Convention on Change of Gauge, held in Atlanta, Ga., February 16th, 1886:*

DEAR SIR:—Pursuant to your call, the following members of the Wheel-Gauge Committee met at the National Hotel, Washington, D. C., July 14th, 1886: Louisville & Nashville Railroad, Reuben Wells; East Tennessee, Virginia & Georgia Railway, W. H. Thomas; Atlantic Coast Line, J. F. Divine; Richmond & Danville Railroad, R. D. Wade; Georgia Pacific Railway, W. T. Newman; Western & Atlantic Railroad, Wm. Kinyon; Georgia Railroad, J. S. Cook; Savannah, Florida & Western Railway, G. M. D. Riley; Norfolk & Western Railroad, S. B. Haupt; South Carolina Railroad, G. H. Gramling; Central of Georgia, Theo. D. Kline.

Absent.—Chicago, New Orleans & Texas Pacific, James Meehan; Western of Alabama, J. E. Warswick; Western North Carolina, G. W. Gates.

The chairman explained the purpose of the call as follows: Applying the limit gauge at junction points, it was detected that cars gauged varied from standard gauge beyond the limit gauge adopted by the convention held in Atlanta, Ga., February 16th, 1886.

As some of the roads looked upon the refusal of their cars as a hardship, it was deemed advisable to call the committee together in order that they might review the work done in Atlanta.

To violate the limit gauge, which was understood to be the extreme measurement, would be to incur unwarrantable risks and fail in the main object—that of bringing about uniformity of wheel gauge and perfect safety in running cars over all the railroads in the country.

The committee went earnestly to work, with full sections of track, frog and guard-rails, adjustable to suit all conditions of both 4 feet 8½ inch and 4 feet 9 inch gauges, with full-size section of wheel, adjustable to all gauges. With the above appliances they made thorough tests under every possible condition intermediate between the limits, also thoroughly tested the limits to determine their correctness. Standard gauges of the largest roads in the country, of 4 feet 8½ inches gauge, were before the committee. The sections of wheel were adjusted to suit the gauges of the following lines: St. Paul, Minneapolis & Manitoba Railway; Kansas City, Fort Scott & Gulf Railroad; Chicago & Eastern Illinois Railroad; Central Vermont Railroad; Houston & Texas Central; Atchison, Topeka & Santa Fé Railroad; Burlington & Missouri River Railroad in Nebraska; Indianapolis, Decatur & Springfield Railroad; Buffalo, New York & Philadelphia Railroad; Lehigh Valley Railroad, and found to work without the least difficulty.

This demonstrated that the standard wheel-gauges of the roads in the country will work and interchange with perfect safety, the troubles experienced being evidently due to improper work in pressing on wheels. The committee having exhausted every possible means in the investigation of both the limit and standard gauges, Mr. Wells offered the following: "As there has been some misunderstanding on the part of some of the roads that have lately changed their gauge to 4 feet 9 inches, as to what the limit of variations allowable in the wheel-gauge is, and difficulties having been experienced in the interchange of cars, the following resolution is offered: 'On investigation we find the limit gauge for testing the gauge of car-wheels, adopted at the meeting in Atlanta, on February 16th, 1886, is correct, and in order to have a uniform limit gauge for the southern 4 feet 9 inches gauge, we recommend that each road obtain from the Roanoke Machine Works a steel master-limit gauge, to be adopted as the standard in making gauges to be used at all points where cars are interchanged with foreign roads.'" Mr. Wells also offered the following resolution: "That in the interchange of cars we recommend that all the southern roads conform to what is known as the Master Car-Builders' Rules, both in regard to receiving cars and making repairs, prices paid for material, and settling for cars destroyed. We believe it to be to the interest of all roads to adopt these rules and be represented in the annual meetings of the association, owing to the fact that the general interchange of cars between the United States and Canada has become universal."

The committee acknowledges the receipt of communications from Messrs. Forney of the *Railway Gazette*, and Ely of the Pennsylvania Railroad, touching the subject of limit gauge.

We feel that there is nothing further that we can do to accomplish the absolute safety requisite in the general interchange of cars, except to urge the importance of all lines giving careful attention to their standard wheel-gauge, and to conform strictly to the requirements of the limit gauge. Respectfully,

THEO. D. KLINE, *Chairman.*

R. D. WADE,	REUBEN WELLS,	J. W. WARSWICK,
WM. KINVON,	G. M. D. RILEY,	J. F. DIVINE,
G. H. GRAMLING,	W. T. NEWMAN,	W. H. THOMAS,
JAMES MEEHAN,	S. B. HAUPT,	J. S. COOK,
G. W. GATES,		*Committee.*

Standard Sizes for Locomotive Tires.

THE following circular has been issued by the secretary of the Master Mechanics' Association, and the committee appointed to report on this subject:

DUNKIRK, September 15th, 1886.

DEAR SIR:—At the annual meeting of the American Railway Master Mechanics' Association, held in Boston, in June, 1886, the report of the committee on Standard Diameters of Driving-Wheel Centers was unanimously adopted.

The sizes proposed by the committee, and adopted by the association, are as follows: 38 in., 44 in., 50 in., 56 in., 62 in. and 66 in.

The committee was instructed to make arrangements with the Pratt & Whitney Company, or some other reputable firm, to make and furnish the railroad companies, locomotive builders and tire manufacturers, standard gauges representing the various sizes adopted, both for the outside diameter of wheel center and for the inside diameter of tire, for each size as given above.

The committee have made such arrangement with the Pratt & Whitney Company, of Hartford, Conn., who are now prepared to enter orders for these gauges, made in accordance with plans submitted to and approved by the committee, and will furnish them either in sets comprising the six sizes adopted, or in pairs, separately, at the following prices, which are net, delivered on board at Hartford, quotations subject to orders being received on or before October 15th, 1886:

Set of six pairs standard reference gauges, for outside and inside measurement, complete in finished cherry cases, with lock, $105.00. For parts of set, in pairs, or for single pair, $26.00 per pair. Cherry cases for parts of set, $5.00 to $7.50 extra.

As it is desirable to have the new system embodying this standard of uniformity introduced at as early date as possible, and in order to take advantage of the exceptionally low prices offered, orders should be placed with the Pratt & Whitney Company on or before October 15th, 1886.

The sizes represented for inside diameter of tire for each of the six gauges in the full set, are as follows:

38 inch,	less	-	0.040 inch,	-	37.960 inch.
44 "	"	-	0.047 "	-	43.953 "
50 "	"	-	0.053 "	-	49.947 "
56 "	"	-	0.060 "	-	55.940 "
62 "	"	-	0.066 "	-	61.934 "
66 "	"	-	0.070 "	-	65.930 "

J. H. SETCHEL, Secretary.

J. N. LAUDER,
JACOB JOHANN,
H. N. SPRAGUE, } Committee.

Coal Delivery to Locomotive Tenders.

CIRCULAR OF INQUIRY ISSUED BY THE COMMITTEE APPOINTED TO REPORT ON THIS SUBJECT TO THE MASTER MECHANICS' ASSOCIATION.

1. Describe the various systems of delivering coal to tenders that you use. If any machinery, staging or special equipment is used, send "blue print" of same.

2. Say why different systems are used at different stations, specifying which you prefer, and giving reasons for preference.

3. Give average cost of delivery per ton under each system, and so that comparison may be made of value, and thoroughly understood. State the average number of tons delivered each 24 hours, the number of men required in the 24 hours, and the average rate of pay per 12 hours for unskilled labor. (It would make this comparison more interesting if, when a special plant such as crane, chutes, staging, etc., is used, its first cost and maximum capacity of delivery per 24 hours were stated.)

4. Describe any special conveniences you are familiar with, for coaling the bunkers of switching, tank and other engines not provided with tender.

N. B.—Replies will be treated as referring to soft coal and the short ton of 2,000 pounds, unless it is otherwise stated.

JAS. STRODE, N. C. R.
CHAS. GRAHAM. D. L. & W.
J. DAVIS BARNETT, G. T. R.
Committee.

Replies to be addressed to
J. DAVIS BARNETT,
Port Hope, Ontario, Canada.

Co-operation in France.

AT the recent coöperative congress which was held at Lyons, France, M. Charles Glide, Professor of Political Economy at Montpellier, described the progress made by coöperative ideas among workingmen. There were, he stated, 600 perfectly organized coöperative societies in France. He was of opinion that the principles of association would not meet with any obstacle in great properties and great industries; small properties and small industries were most likely to command the future. At present the coöperative workshops and shops could compete with those of the capitalists. The working class could only hope to reach the position to which it aspired by fulfilling two conditions. It must, in the first place, find men accustomed to direct enterprises and to command, those having sufficient intelligence and good-will to yield to men possessing more experience than themselves. In the second place, it must, by its savings, collect capital and learn how to turn it to account. M. Glide concluded with a refutation of the doctrines of the leading socialists, which was warmly applauded.

Meetings and Conventions.

THE *Order of Railway Trackmen of North America* will meet at Council Bluffs, Iowa, November 25th, to organize an association.

The *Master Car-Builders' Club* holds regular meetings at the rooms, No. 113 Liberty street, New York, on the third Thursday of each month.

The *Western Railway Club* meets in Chicago, the third Wednesday of each month, at 2 o'clock P. M.

The *New England Railroad Club* meets at its rooms in the B. & A. station in Boston, the second Wednesday of each month.

The *Western Society of Engineers* meets at its hall, 15 Washington street, Chicago, the first Tuesday of each month, at 7:30 P. M.

Distributing Profits to Employés.

THE Rochester Lumber Company have notified their employés that a part of the concern's profits will be distributed among them at the end of the term beginning October 4th, 1886, and concluding October 1st, 1887. It is proposed to distribute about $4,000 among the men as a recognition of faithful service. The money will be paid as a bonus for making big wages. The employé earning the largest wages will be given $150, the second $125, and so on down to the tenth man, who will receive $40. The shop making the largest turn will be given $100 to be divided among the men, and the boy who is not absent a turn will be presented with $30.

Society of Railroad Water-Supply Superintendents.

A "SOCIETY of railroad water-supply superintendents" was organized in Cedar Rapids, Iowa, on September 16th, the object of which is stated in the constitution to be for mutual improvement, and the discussion of all matters pertaining to hydraulic engineering as applied to the railroad service, and not in any way to interfere with each other or their employers, or for the furtherance of strikes, or religious, or political purposes. Correspondence with railroad water-supply managers is solicited at 171 South Sixth street, Cedar Rapids, Ia., by the secretary, J. White.

Railway Reading Lamps.

AT the recent meeting of the British Association, Mr. Preece showed some portable electric accumulator reading lamps. A cubical box of about four inches, and containing four cells, weighs six pounds, and the lamp will burn twelve hours; another form of battery, of about one-third this width and half the weight, is not more cumbrous than a book; the little lamp is fastened by a hook to the waistcoat. The one exhibited had startled many a fellow-passenger of Mr. Preece's, and otherwise done good service for a fortnight.

NOTES AND NEWS.

MR. J. A. MEYER, of the Grant Locomotive Works, has resigned his position in that company to join the editorial staff of the *American Machinist*, as announced in its last issue.

THE EFFECT OF THE EARTHQUAKE:—The position of a small railroad trestle, on the line of the Northeastern Railroad, in South Carolina, is said to have shifted seven feet from its original center, by the recent earthquake.

MR. THOMAS A. BISSELL, recently superintendent of the Barney & Smith Manufacturing Company, of Dayton, Ohio, has been appointed manager of the New York Central Sleeping Car Company, in place of Mr. T. H. Munsell, resigned.

THE POUGHKEEPSIE BRIDGE:—The general plan of this bridge has been changed. There will be three cantilever spans and two trusses, the spans nearest the shore on each side and the middle one being cantilevers, instead of three truss and two cantilever spans.

THE BLOCK SYSTEM, and interlocking points and signals, Consul-General Waller reports, are generally in use in the United Kingdom, and a smaller compensation account for personal injuries is the acknowledged result. In ten years this expense has been reduced from 1 cent to one-sixth of 1 cent for every train mile, and the reduction for damage to freight, it is said, has been nearly as great.

MESSRS. RIEHLÉ BROTHERS have received among their recent orders two large testing machines for the Union Pacific Railway Company; one 100,000 pound testing machine, "Haward" type, for University at Terre Haute; one of same size and style for Washington University, of St. Louis; one cement tester for Institute of Technology, Boston; one foundry tester for Bishop & Co., Bangor, Maine.

RAILWAY MATERIAL FOR JAPAN.—The London *Morning Post* states that the Japanese Government is now arranging to place very large orders in England for the engines, rails, bridges, and plant required for the railway development which it has been decided to execute immediately. This disposes of the recent report that a German firm had obtained an eight years' monopoly for supplying rails for Japanese railways.

THE PENETRATING POWER OF THE ELECTRIC LIGHT IN A FOG:—Sir William Thomson stated, at the recent meeting of the British Association, that there was no discoverable difference in the penetrating power of the electric light and gas light in a fog. When the fog was such as to redden the sun or moon, then, for piercing power, gas or oil would be found to be of superior quality, but when the fog left the sun white there was no sensible difference in either light.

SLEEPERS ON THE MEXICAN CENTRAL RAILROAD:—Eight hundred miles of this road were originally laid with sawed-pine sleepers from Arizona, and 425 miles with Mexican pine. These, it has been found, do not last longer than four years, which is their maximum endurance. During the last fifteen months, 300,000 new sleepers have been put down. Those laid on curves are mesquite, which is a native Mexican wood, and Michigan cedar is put in the straight line. The Vera Cruz Railway is putting in steel sleepers.

THE DOMINICAN GOVERNMENT has given to Mr. George H. Blake, of Portland, Maine, the right, for ninety-nine years, to establish a railroad across the Republic, beginning at the bay of Calderos on the south, and terminating at the bay of Mansanilla on the north. These two harbors or ports are the best and safest commercial centers on the island, being superior to the bay of Samana, which surpasses them only in size. Vessels of heavy draught can approach alongside the banks of these harbors, whilst at Samana it necessary to lay in the offing. For coaling stations they offer great facilities.

A DEVICE TO DRAIN LOCOMOTIVE CYLINDERS:—Mr. William McKenzie, general foreman of the New York, Pennsylvania & Ohio Railroad machine-shop at Meadville, has invented a device for ejecting water from the cylinder of a locomotive; it is described as follows: "The steam ports on either side of the locomotive are connected with a small pipe, to which is attached an automatic valve directly back of the saddle. When the locomotive is under steam pressure this valve remains closed, and opens the moment the pressure is shut off, thus allowing every drop of water that has accumulated in the ports to escape."

MILFORD HAVEN:—When the improvements in the docks of this port are completed they will have an area of twenty acres, with a depth of thirty-four feet, and will accommodate, when finished in a year from now, the largest Atlantic steamers. The sea passage to America is 170 miles shorter than that from Liverpool, besides avoiding the risks and delays incident to the navigation of St. George's Channel. It is surprising that the advantages of this port for the accommodation of transatlantic traffic have so long been neglected, but it seems probable that, in the near future, passengers will be landed at Milford Haven instead of Liverpool.

RAILROADS IN THE ARGENTINE REPUBLIC:—Consul Baker reports that during the last year, 1885, in spite of the deranged financial condition of the country, there has been no cessation in the work of railway construction, and several new lines and extensions have been opened to traffic. The most important of these are the roads to Mendoza and San Juan, and the branch of the Cordova & Tucuman road to Santiago del Estero. The road from Buenos Ayres to Rosario is now almost completed, and will be opened to traffic in a few weeks, thus making an uninterrupted railway communication from this city (Buenos Ayres) to the farthest confines of the Republic. Meanwhile, the work of construction upon the direct Buenos Ayres and trans-Andine road through Mercedes goes on without interruption, and is now entering the province of Santa Fé. The Republic now has a total distance of 4,128 kilometers (2,565 miles) of railway completed, with 1,978 (1,229 miles) in process of construction.

A MERCURY TRAIN-SIGNAL:—The firm of Siemens & Halske have introduced a mercurial key for actuating an electric indicator, and signaling the passage of a train at any part of the line where it may be fixed. The late M. Lartigue exhibited a mercurial commutator applied to a similar purpose at the Paris International Exhibition of 1878. But Messrs. Siemens & Halske's apparatus differs, we believe, from M. Lartigue's. In the new commutator the pressure of the rail, bending under the weight of the passing train, is caused to depress an elastic diaphragm, thereby forcing the mercury in a reservoir below the diaphragm to rise in a tube communicating with the reservoir, and thus complete the electric circuit and signal the train. Lartigue's apparatus is worked by the tumbling over or canting of the mercury. This canting of mercury has also recently been applied by Mr. Suyers, of Brussels, and others, as a simple "make" and "break," on a small scale, for electric light or other currents.—*Engineering*.

CARS HEATED BY STEAM FROM THE LOCOMOTIVE:—In a letter to the *American Engineer*, Mr. James Emerson says that, some fifty years ago, George Stephenson tried to heat the coaches of his trains by the steam from the locomotive, but failed. Five years ago, the superintendent of the Connecticut River road employed him (Emerson) to try the plan, in order to do away with the terrible accidents so common through the use of stoves or heaters in cars. Commencing with one train, the method produced so much comfort and satisfaction that, at the close of the last winter, twenty trains each way per day were heated in that way, and the five years of experience have proved the perfect practicability of the system. It is cheaper, neater, more safe and convenient, and the traveling public will not dispute the broad statement that the cars of the Connecticut River Railroad, heated by steam from the locomotive, stand unequaled in temperature and ventilation by the cars of any other road that can be named.

American Railroad Journal.

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NEW YORK, NOVEMBER, 1886.

Principal Contents of this Number.

MISCELLANEOUS AND SELECTED.

NOTES AND NEWS.

EDITORIALS.

NEW PUBLICATIONS.

STREET-RAILWAYS.

MANUFACTURES.

NEW INVENTIONS.

ANNOUNCEMENT.

THE AMERICAN RAILROAD JOURNAL has been sold to Mr. M. N. FORNEY, who will be its editor and owner from this date. He has also arranged for the purchase of *Van Nostrand's Engineering Magazine* on the completion of its current volume at the end of this year. The two publications will then be consolidated with the title of the AMERICAN ENGINEERING MAGAZINE AND RAILROAD JOURNAL, which will be devoted to the discussion of engineering and mechanical subjects. Railroad construction and operation being, however, the most important branches of engineering in this country, more space will be devoted to them than to any other one department of engineering. Questions of traffic and finance will not be taken up, excepting so far as they are incidentally concerned with engineering matters.

The new publication will have, each month, about double the amount of reading matter heretofore contained in the RAILROAD JOURNAL—the subscription price, $3.00 per year, will remain the same as heretofore.

The office of publication will hereafter be at No. 23 Murray street, New York.

HOW TO BE REALLY PRACTICAL AND REALLY EARNEST ABOUT CAR-COUPLERS.

IN the last number of the RAILROAD JOURNAL we ventured to jeer a little at the rather confident interrogative observation with which the *Railway Review* concluded an article on automatic couplers. It replies in a very personal editorial, too long for the limited pages of the JOURNAL. The remark which, perhaps, amused others, besides those who control these pages, was the inquiry whether "it is not about time that something really practical and really earnest should be done with this matter?" (meaning automatic couplers). To the invitation that the *Review* should suggest, in the form of a "resolution," just what ought to be done, our cotemporary makes three responses as follows:

1. "That the secretary has received 'retainers' to aid the progress of the Master Car-Builders' Association, and that 'suggestions, rather than blank queries, would seem rather more suitable from him.'"

2. "Why not frankly concede that the matter has been mismanaged, and that a new policy is needed? Take up the question anew. Come to it on the same plan as that inaugurated at Buffalo, but come to it in a broader spirit. Let the opening work not be hurried. Let extreme care and painstaking govern, as they governed the admirable brake work at Burlington. Let the decisions be slowly made. And let the essence of the whole inquiry lie where it belongs—in the endurance tests—and let these tests be systematically planned, systematically followed up, sys-

tematically recorded, and honestly reported and studied."

3. "Let a special convention be held to discuss the matter, and to appoint a committee which shall be charged with a work of investigation, modeled upon the plan of the brake committee's inquiry into the freight-car brake question."

With reference to the first suggestion, it may be said that it is open to the objection of being inaccurate. The dictionary defines "retainer" as "a fee paid to engage a lawyer or counselor to maintain a cause, or to prevent his being employed by the opposite party." Excepting his salary, the secretary has never received a cent of money from railroad companies, or the association, "to aid its progress." The salary is paid for attending to the duties of the office, and the receiver of it believes that it has been fully earned. The executive committee, whose duty it is to appoint the secretary and fix the salary of the office, are apparently of the same opinion, otherwise they would turn out the present incumbent and appoint some one else, which they can do at any time. It may be added that, if the majority of the members of the executive committee should hold the opinion that the secretary does not earn what is paid him, they would be abusing their trust if they did not put some one else in his place.

Further, the Master Car-Builders' Association has referred the "coupler question" to the executive committee, of which the secretary is not a member. Under these circumstances it would be an act of impertinence on his part to indicate what they ought to do, unless the committee ask for such suggestions. So much for personal explanation, the need for which is very much regretted.

The suggestions of our cotemporary, contained under the second head above, are most of them very good, and probably very few persons interested in the coupling question would object to some one else doing what is therein proposed. Perhaps the executive committee might not be willing to concede "that the matter has been mismanaged," but probably none of its members would find fault if any number of parties, including our cotemporary, "came to the question in a *broader spirit*." In fact, if the spirit manifested was as wide as the ocean, so much the better; full liberty would be allowed to such missionaries to spread themselves out as much as they liked.

The suggestion that "the opening work should not be hurried," that "extreme care and painstaking should govern," and that "the decisions should be slowly made," would not meet with any opposition. In fact, it is believed that full and complete liberty would be allowed to any one or number of persons to muse on the coupling question as long as they chose. They would also be permitted to "plan, follow up, record, report, and study tests systematically." But who is to do this work? It will require a very large amount of time, labor, and, if properly done, a high order of ability. How are the services of competent persons to be secured? The members of the Master Car-Builders' Association are all very busy men. They could not, if they would, give the required time to such work, and probably would not if they could—without adequate compensation. If such compensation is offered, where is the money to come from? The present receipts of the association are barely sufficient to pay its expenses.

The third suggestion of our cotemporary is also a good one—if it will work. By all means hold a convention of general managers and general superintendents to discuss the subject, appoint a committee, etc., provided the managers and superintendents will consent to convene. So far, the superintendents and general managers have not manifested any desire to hold such a convention. If they wanted to hold one, they would, doubtless, do it without being urged.

To sum up—in response to the invitation to suggest, in the form of a "resolution," just what ought to be done about the coupler question—our cotemporary answers, in substance, "you tell." Next it proposes that a long and laborious investigation should be made by some one or more persons, not named, either without compensation or without providing "ways and means" for defraying the expenses. The third suggestion is, to "hold another convention," which is the great American remedy for all public ills. It may be left to the readers of the JOURNAL to decide whether the action proposed would be "really practical and really earnest."

The fact is that, at the present time, the difficulties in the way of the general adoption of any automatic coupler appear to be insurmountable. There are so many diverse interests and opinions, that a reconciliation of them and a general agreement, with reference to the subject, appears to be impossible; and many who understand the subject best have come to the conclusion that much more can be done to save life and limb in coupling cars, by improvement of non-automatic coupling-gear, and providing safeguards between the cars, than is possible through any attempts to secure the adoption of any one or a few automatic couplers at the present time. If the railroad commissions and the *Railway Review* would give their authority and aid to secure a uniform height for drawbars, uniform non-automatic draw-gear, and an adequate clear space between cars when they come together, with suitable hand-holds for the men, they would do much more to save life and accident, than they now do by prescribing the use of a variety of automatic couplers, and publishing frantic appeals to be really practical and really earnest. In fact, the work suggested is going on quietly,

as is shown by the recent adoption of standard dead-blocks by the Master Car-Builders' Association, and another step would have been made in advance, if the recommendations of the committee looking to the adoption of a uniform height for draw-bars for all cars, in all parts of the country, had been received in a more liberal spirit than it was at the last convention of the association. A new committee has been appointed this year to recommend plans for a standard non-automatic draw-gear for freight-cars. If that committee will do the work assigned to them in a "really practical" and "really earnest" way, as no doubt they will, they will be able to accomplish more for the safety of trainmen than now seems possible through any attempt to introduce automatic couplers.

STANDARD FORM FOR CAR-WHEEL TREADS AND FLANGES.

AN engraving of the standard form of tread and flange for car-wheels, which has just been adopted by a letter ballot of the Master Car-Builders' Association, will be found on another page. This is the third time that forms for the treads and flanges of wheels have been submitted to letter ballot. In 1883, two different ones were voted on, one for steel tires and the other for cast-iron wheels. Both of these had coned treads, but that for cast-iron wheels was beveled off on the outer edge, very much as shown in the engraving published with this number of the JOURNAL. The form for steel-tired wheels had a continuous cone from the flange to the outer edge of the tread. The absurdity of having different forms for cast-iron wheels and steel tires, seems to have been apparent to the members when they voted. At any rate, neither of the forms succeeded in getting the requisite two-thirds vote.

In 1884, another form with a cylindrical tread, to be used for both cast-iron wheels and steel tires, was submitted to a letter ballot. It was also defeated. At the last convention the form, of which an engraving is given on another page, was referred to a letter ballot, and has received more than a two-thirds vote, and, consequently, is adopted as a standard. It differs very slightly from the form for cast-iron wheels proposed in 1883—so little, in fact, that probably those who have made chill-molds of the earlier pattern, would hardly consider it essential to change them.

This vote ends a long dispute, and will, undoubtedly, do much to make railroad traffic safer and surer. With a uniform shape of flanges it will be possible to have a uniform gauge of wheels, which is not possible with the present diversity of shapes and proportions. It is to be hoped, too, that when railroad companies order wheels they will hereafter specify that they must have the standard form of treads and flanges.

THE New York *Evening Post*, in commenting recently on a picture published in *Harper's Weekly* showing the condition of the wrecked smoking-car, in which fourteen persons lost their lives in the Silver Creek accident, says: "This car, which was directly behind the baggage-car, was driven entirely through the latter and almost ground to pieces in its progress. Such a picture as this indicates that some one in higher authority than the engineers and conductors on the unfortunate trains is to blame for this disaster. Undoubtedly, some subordinate made a criminal mistake. But with modern appliances for safety on railroad trains, and the modern system of car building, no such crushing of cars like egg-shells ought to be possible. A well-made modern car, with safety-buffers, will rear on end before it will give way to longitudinal pressure."

Just what the writer of the above meant by "safety-buffers" is not clear. If they will prevent cars from telescoping in collisions, no doubt many railroad managers would like to know about them. In the accident referred to, one of the cars was raised up sufficiently so that its floor and the floor-timbers were above those next to it. The two cars then offered very little resistance to each other, as the floor of the one crushed through the side of the other. This occurs in many accidents, and the question arises whether some provision should not be made to keep cars in line, vertically, in case of collision. With the Miller and the Janney couplers there is no such provision, and one car is free to rise above the other when an accident occurs. Blackstone's platform, which is, or was, used on the Chicago & Alton Railroad, is made with projecting timbers. These are arranged so that the timbers on one car interlock with those attached to the platform next to it; which prevents one car from rising above the other, or, in other words, hold the cars in line with each other in collisions.

* * *

CODE OF GENERAL AND TRAIN RULES:—At a meeting of the General Time Convention, held in New York, on October 13th, 1886, an elaborate code of "general and train rules" was approved, and has been printed. These are to be finally acted upon at a meeting to be held in New York, April 13th, 1887. The code, as approved, is, unfortunately, too long for publication in these pages, but will, doubtless, be issued in some form so as to be accessible to our readers.

NEW PUBLICATIONS.

Supplement to the Steam Engine Catechism. By ROBERT GRIMSHAW, M. E., Etc. New York: John Wiley & Sons.

This is a supplement to the original book named above, and, as the author says, the new volume "contains the answers to many questions which were asked by engineers and steam users, the answers to which do not appear in the catechism itself." The questions are such as would,

and probably did, occur to practical men, and which they should be able to answer. A few illustrations are given, among them the Joy valve-gear. A defect of the book is the want of systematic arrangement, but that is a matter of convenience only. Practical engineers will find this supplement very useful and suggestive, and it is for them that it was written.

Topographical Drawing and Sketching, Including Applications of Photography. By LIEUT. HENRY A. REED, U. S. Army, Assistant Professor of Drawing, U. S. Military Academy, West Point, N. Y. New York: John Wiley & Sons.

Only an extended review, for which there is not room, could do justice to this handsomely printed and illustrated book. Its size is 12 × 9½ inches, and it contains 130 pages besides 24 folded plates. It treats the subject of topographical drawing in a very plain and lucid manner, and evidently it has been the object of the author to make the path of the student and learner of the art of topographical drawing as easy as possible, instead of befogging it with technicalties which are useless. Probably some draftsmen would dissent from the author in some of his practical suggestions. Thus, he recommends drawing-pens with "one nib hinged at its base." Pens of this kind most practical draftsmen regard as a source of constant annoyance. The hinged joint will get loose, with the result that the points of the pen will not coincide, and will, therefore, not draw an even line. The use of the hinged joint to facilitate the cleaning of the pen is, to a great extent, imaginary. Pens without such joints can be readily cleaned with a piece of soft linen cloth—an old, worn-out linen pocket handkerchief is best.

The directions, too, for pasting down paper on a board, it is to be feared, would not teach a novice how to do it successfully.

The book is, however, so good, that these minor defects will detract very slightly from its usefulness.

TRADE CATALOGUES.

The Sheffield Velocipede Car Company have issued a new catalogue of the hand-cars and other articles which they manufacture. The cover is resplendent in bright colors, and has the merit that it attracts attention at once. The illustrations of the various kinds of cars built by this company, which are given in the book, are all very good. It is also gratifying to see that the men who are represented on the cars do not look like criminals, as is usually the case, when engravers of mechanical work cut human figures. The illustrations show the advance which has been made in the construction of three-wheeled cars, which were first introduced only a few years ago. The book also contains engravings of four-wheeled hand-cars for section men and for other uses, stand-pipes, or water cranes, the "Hagan safety" steel car-wheel, and the "Security" grain-door, all of which are manufactured by this company.

James T. Conneily, of Lima, Ohio, has issued a little pamphlet on what he calls his "Gusset Connection" for steam boilers. The evils of the old method of constructing boilers are pointed out, but there is no description of the new "Gusset Connection," nor of how it remedies the evils indicated. The result is that the reader has very little more idea of what the "Gusset Connection" is, or is intended to do, than he had before he read this pamphlet.

Street-Railways.

BLACKPOOL ELECTRIC TRAMWAY.

AT the recent meeting of the British Association, Mr. M. H. Smith read a paper on the above subject, of which, and of the discussion which followed, *Engineering* gives the following abstract:

"In the Blackpool Electric Tramway there is between the rails an underground channel for carrying the electric conductors, Communication is made with the motor on the car by means of a narrow opening in the top of this channel. The three leading conditions that have to be kept in view in planning an electric tramway—or, for that matter, any other tramway—which has to run in the public streets, are (1) safety to the public; (2) efficiency; (3) economy. So far as the first consideration alone may be concerned, the author admitted that, with perhaps a few reservations, the end may be obtained by the use of secondary batteries; but he thought it would be admitted that they were not desirable in cases in which electricity could be used direct. If with the latter system safety could be obtained—and the author contended he had solved the problem—while the other two conditions were secured, the direct method was clearly the most advantageous. It had been proposed to use the rails as conductors, but this was an impracticable scheme, and overhead lines were also out of the question in a street-railway. The only plan left was to place the conductors below the level of the street and devise the best means of making connection. Insulated copper bands, which are protected by steel plates, pass down through the opening in the top of the channel carrying the conductors. There is a flexible, insulated cord attached to a terminal beneath the car, and as the car moves forward the collector is drawn along with a force sufficient to clear its way through any obstruction not sufficient to cause a serious accident or leakage to the mechanism. If any great strain is brought to bear, there is a special appliance for releasing the cord, which is naturally brought to a standstill. The current passes from the terminal under the car to a switch-box, one being placed at each end. Here the amount of power required, according to speed, load, gradient, etc., is regulated. It is here also the reversing of the car is effected. We should have mentioned that the sides of the channel are formed of blocks of creosoted wood, and these carry the insulators to which the conductors are attached. Two lines of conductors are used, but the return current passes to the rails.

"The motor is designed to run at a high speed, and the motion is conveyed to the driving-wheels by means of a pitch chain. The return current passes through clips to the axles of the car, and then, by way of the wheels, to the rails.

"The line is two miles long, and the generating station is placed about midway. The whole machinery is in duplicate. During the present season nine cars have been constantly running, and they have been mostly crowded. There is no Sunday traffic; 42,000 passengers have been carried in one week. The cost for coal has been at the rate of thirty-five passengers carried one mile for one half-penny.

"An interesting discussion followed the reading of the paper. Mr. Horsfall, the chairman of the company that is working the tramway, gave some figures bearing on the financial aspect of the scheme. The gross receipts for the week ending June 4th, were £67 1s. 1d., and the expenses £30 18s. 4d. For the last four weeks the receipts had been £330, and the working expenses, including wages and materials required, £45. Their total receipts had been £4,038 16s. 1d. During the winter months, the receipts did not pay the cost of working, but the speaker hoped that matters would improve in this respect, and there would even be a slight balance to the good on the winter traffic. From the experience he had gained, he believed there was a great future before electric tramways. It had been the misfortune of his company that they had to pay for experience, but this experience would doubtless be utilized by future companies. Their two miles of line had cost them no less than £30,000. Captain Douglas Galton would have liked to have had fuller details of working expenses, but the line had been so recently laid that, perhaps, the author had hardly the figures at his command. He thought it well to remind the meeting that this system which had been described was not the only method by which electrical tramways could be worked. At Brussels, he had seen cars being run by accumulators; there were many points in favor of that arrangement, and if they could be proved to be economical they were undoubtedly desirable. One great advantage would be that the great expense of keeping the underground works clear would be avoided. At Antwerp, also, the same system was in use and working well, but there the line was quite level, while at Brussels several hills had to be encountered.

"Mr. Jeremiah Head and Sir Frederick Bramwell having spoken, a gentleman, whose name did not transpire, but who stated that he had been engaged as surveyor for the electrical tramway at the Giant's Causeway, criticized the figures that had been given bearing on the financial aspect of the scheme. He thought £30,000 for two miles of line a very high expense.

"Professor Perry alluded to the difficulties of carrying out electro-mechanical arrangements in the present position of scientific knowledge. He thought the track a very expensive one. In conjunction with Professor Ayrton, he had made researches in another direction of the same subject, and the result had been that they had patented a system of telpherage, by means of which no opening was made into the place where contact was made. He thought that he and Professor Ayrton were the first to run an electrical carriage on common roads. This was a tricycle. He would like to ask whether the author had found any difficulty with the motors. He, the speaker, had tried many, and had always met with trouble. The mechanical parts of such machines were always badly designed, and electrical engineers seemed to have the crudest notions of the common principles of mechanical design. He could give many instances from his experience. In one case, the nuts had been soldered on; that was sufficient, the speaker thought, to give a general idea. If any competent mechanical engineer would master just enough electrical knowledge to enable him to design a workable motor, he would be conferring a lasting benefit on his kind. Professor Perry next referred to the question of resistance. Telegraph engineers, he remarked, often took exception to the high resistances that had come into use of late, but they were apt to forget the great proportion of power used in such work as that now under discussion. No doubt, if there was the same resistance in telegraph wires, messages could not be sent.

"Mr. G. Kapp commented on Professor Perry's remarks, and said that he had been trying to produce a low-speed motor, but had not succeeded. There were two conflicting elements to be considered, and one either got a machine mechanically correct and electrically imperfect, or the electrical properties were improved at the expense of the mechanical considerations. The low-speed motor he had designed would not start fairly, as it always commenced with a sudden jerk. He would like to ask the author of the paper if he found any difficulties arise through the breaking out of teeth, etc., in his under gear.

"Mr. Smith, in replying to the discussion, had the accompaniment of a violent thunderstorm, which indeed lasted, with greater or less intensity, for the remainder of the day. Reference has been made in the course of the discussion to the loss of electromotive force, as shown by diagrams exhibited on the wall. This, no doubt, was a weak point, and the speaker thought it could possibly be attributed to an oxide scale which forms on the faces of the wedges by means of which electrical connection was made in parts. Professor Perry had referred to telepherage, but he, Mr. Smith, thought that it could not be practically applied for the purposes they had in view. He could not speak favorably of the motors on the cars, but if electricians would take the designing of motors into their own hands, they could hardly hope for a happy result. They were getting 80 per cent. efficiency out of their motor. He showed examples of their brushes, and attributed this high efficiency in a great measure to their use. They had no sparking. As to the gearing, they had not had a broken tooth yet. The stretching of the chain was the great trouble, and as those responsible often let them run too long, from a false economy, the links would override the teeth. He had devised a worm gear, which he hoped would be a success. He had fitted a car sent to France with a worm gear, and found it ran very successfully. There was no great loss, the speaker said, even when the wheel was driving the worm. The first cost of the line had been commented on. This was £30,000, but the total cost of engine, house, wires, gear, and fitting was under £12,000. This included all the electrical work. With regard to accumulators, he could not impress on his hearers with too much force the fact that heavy work cannot be done with light accumulators. The total cost of fitting the line with accumulators would be 15 per cent. more than in the system he had adopted, and then they would have to carry three tons on each car. They were not only working cheaper with the present plan, but the first cost was less. They had carried 32,000 people at Blackpool, and had spent less than £5 on coal. No other tramway, to his knowledge, could be run so economically.

AT Montreal, Canada, a double-track has been put in on St. Catherine street; a loop is to be built on St. James street to obviate switches on Notre Dame street. There have been complaints that the cars are not kept in circulation as required by the by-laws.

STREET-RAILWAY NEWS.

CALIFORNIA.

THE San Diego Street-Railroad Company has ordered from St. Louis, Mo., steel rails for four miles of extensions.

A franchise has been applied for for a new street-railroad in San Francisco.

The San Francisco Bridge Company has petitioned for leave to maintain its tracks for steam-cars on Kentucky street for one year.

COLORADO.

Denver's electric street-railroad is working successfully. The wires are laid in conduits between the rails, and an "arrow" attached to the car moves in the conduit, and, by contact with the circuit breakers, keeps up the communication with the motor on the car.

CONNECTICUT.

Work has been commenced on the street-railroad at Meriden, and it is intended to have the road in operation within three months.

DISTRICT OF COLUMBIA.

A company has been incorporated to build a street-railroad, to be worked by electricity, from Washington to near Bladensburg, Md. The line will be eleven miles long.

GEORGIA.

Work was commenced October 4th on the street-railroad at Dublin, and the road is to be in operation in December. Freight will be hauled. Capt. Smith is at the head of the enterprise.

ILLINOIS.

The North Chicago Railway Company will put in a new form of cable, in which the President, Mr. Yerkes, is interested. No dummies will be required, each car having a grip attachment worked by means of levers on the platform. It is claimed that greater speed can be obtained with this new form of cable. Manholes to the conduit are placed at every 31 feet 6 inches.

The West Division Railway Company, of Chicago, has been authorized by the city to run a compressed-air motor, the "Lillie," between the stables and Douglas Park, along Ogden avenue. The purpose is to test the feasibility of running motor-trains on the west side.

The North Chicago City Railroad Company has been granted a modification of the Story injunction; the company can proceed with its preparations for constructing the cable line, such as getting the permits and putting material along the route, but cannot commence work on the excavation till after the hearing of the case to dissolve the injunction.

The Illinois Central Railroad Company has paid considerable attention to its suburban facilities out of Chicago. From the city to Kensington, 15 miles, there are two tracks used for suburban trains only; and another exclusively suburban line is from Sixty-seventh street to South Chicago, 5½ miles. Frequent trains of handsome cars, hauled by engines constructed specially for this traffic, are run, and the company is doing its best to maintain an efficient and convenient suburban service. The rates are low, and for a distance of five miles the trains compete successfully with the cable cars.

The Pullman Car Works at Chicago are quite busy with orders for cars for electric railroads; among others are four for the Scranton, Pa., People's Street-Railroad Company.

The Illinois Cable Transit Company, of Chicago, has been incorporated. Capital stock, $400,000. Louis Wachsmith, H. W. McNeil, and D. C. Cregier.

The Continental Cable and Grip Company, of East St. Louis, has been incorporated by H. L. Fox, T. C. Smith, and J. Brown. Capital stock, $1,000,000.

IOWA.

In the case of the Des Moines street railroads, Judge Henderson has decided between the rival companies that the old company has no exclusive right to the streets, and if it has exercised it, it has only been by the toleration of the public. This decision has depreciated this company's stock.

KANSAS.

The Ness City & Sidney Street-Railroad Company has been incorporated by C. B. Lyons and others, with a capital stock of $25,000.

KENTUCKY.

The majority of the stock of the Lexington City Railroad Company has been sold by Messrs. Cross and Diver, Little Rock, formerly president and vice-president, respectively, to R. B. Metcalf, now president and general manager, and B. Cross, superintendent. The capital stock of the company is $60,000; and the transfer represents $32,000.

MASSACHUSETTS.

A strike has been brewing among the employés of the Highland-Middlesex Consolidated Street-Railroad Company, in consequence of new and inconsiderate rules being instituted.

It is a very general opinion that Boston needs an out-of-town elevated line to accommodate the heavy morning and evening traffic, for which the surface street-railroads are entirely inadequate.

At Winchester, the petition of the Woburn Street-Railroad Company for permission to extend its line to the Medford line at Symme's Corner was granted.

The North Adams Street-Railroad Company has received four new cars, but will not run any more cars till the completion of the road.

Horse-cars are now running at Bradford, and are proving a great public convenience.

A survey has been made for a two mile street-railroad between South Framingham and Framingham Center, to be operated on the Chandler electric suspension-cable system. The cars will be lighted by electricity.

The minority of the stockholders in the Onset Bay Grove Association have filed a bill in equity to compel a careful separation of the accounts of the Onset Association and the Onset Street-Railway Company.

MICHIGAN.

Cars will soon be running on the Highland Park Electric Railway at Detroit. The track is laid at the side of the road, and a center rail (8 pounds per yard) supported on glass insulators between the track rails conveys the electricity, which is taken up to the motor on the car by means of a loose wheel, which is raised or lowered as the

car is to start or stop. New engines and dynamos have been put in; the dynamos are 45-horse power each and are estimated to each run five or six cars. The stockholders are Capt. W. H. Stevens, Frank E. Snow, John B. Corliss, F. Woodruff, W. A. Jackson (who has supervised the work), and others.

The cars will be running very shortly on the new electric railroad, on the Van De Poele system, at Port Huron.

MISSOURI.

Preparations are going forward at St. Louis for the trial of the Terry cable system, which the street-railroad companies have decided to experiment with. Work has been commenced on the excavations for the trench, and the working drawings have been in preparation at the office of Messrs. Smith, Beggs & Rankin, who will build the machinery.

NEW YORK.

The New York Cable Railway Construction Company, capital stock $200,000, has been incorporated by C. D. Ingersoll, Frank Lloyd, H. L. Storke, Cornelius V. Sidell, Wm. C. Reddy, Creighton Webb, Edmund Beardsley, J. F. Shelly, and C. S. Beardsley. Its purpose is to build and equip cable railroads in New York, New England, New Jersey and Ohio.

The North & East River Railway Company has been incorporated to build a double-track line in New York City, from Fulton Ferry along Fulton street to the Cortlandt street and Pavonia ferries on West street. Application has been made to the city for permission to build the line.

The New York District Railroad Company has been unable to secure the requisite number of consents from property owners on Broadway, and has, therefore, applied to the Supreme Court for the appointment of commissioners to report as to whether this underground road shall be constructed.

The Ninth Avenue Elevated road will again be worked with a Daft electric motor, a new one of 125-horse power having been constructed for the purpose, which, it is expected, will haul four or five cars. The one used last spring was only 60-horse power, and could only haul two cars. It is also proposed to use electric motors on the Third Avenue Elevated road.

The Morris Avenue Street-Railroad will be extended from Third avenue to 149th street, and along 149th street, Cortlandt avenue and 161st street to Third avenue again.

The Kingsbridge line will be extended from Fleetwood Park along Jerome avenue and Kingsbridge road to Kingsbridge and Riverdale.

A street-railroad is projected from Third avenue along Westchester and Prospect avenues to 156th street; and another from Third avenue along 138th street, Mott avenue and 163d street to Fleetwood Park.

The grant for the cable system to the Atlantic Avenue, and the Prospect Park & Coney Island railroad companies was materially delayed by the accidental insertion of Melrose street in the grant. All is now straight and the necessary authority has been given.

The South Brooklyn Street-Railroad Company has been incorporated by T. McGrath, and others. Capital, $200,000.

The Riker Avenue & Sandford's Point Railroad Company has been incorporated by George A. and William Steinway, and others, with a capital of $20,000, to build a two-mile line from Long Island City to Flushing Bay.

The Troy & Averill Park Railroad Company has been incorporated to build a suburban line 7½ miles long. Capital, $75,000.

The Fairchild's cable system (now in use at Binghamton,) will be laid on the State street line of the Albany Street-Railroad.

PENNSYLVANIA.

An elevated railroad company, with $6,000,000 capital, has been organized at Philadelphia, George Baker, president.

The Metropolitan Railroad Company has been incorporated, with a capital of $2,225,000, to build an underground line from Upper Darby, through Philadelphia to Chelten Hills, 15 miles.

Mr. William Wharton will build a gravity railroad in the West Park, Philadelphia. It will be 6½ miles long, and can be worked by gravity with the exception of about 3,500 feet at the inclined plane.

The Electric Motor Railway Company, of Pittsburgh, has decided upon an issue of $60,000 of bonds.

The Second Avenue Passenger Railway Company, of Pittsburgh, has abandoned its proposed Forbes street line owing to the strong opposition to the line, and will apply for a route that will practically parallel Forbes street.

At Lancaster, Pa., the East End Railway Company has been granted its right-of-way.

There are forty-four street passenger railroads in the State, employing 4,398 men, who receive $2,535,378.

TENNESSEE.

The Columbia Street-Railroad Company has been incorporated by Thomas T. Wright, J. T. Craik, and others.

At Knoxville a company is being organized to build 3½ miles of street-railroad.

The Chickamauga & Rossville Street-Railroad Company has been incorporated by J. C. Roberts and others, to build from Chattanooga to Rossville, Ga. The road will be built within six months. Capital stock, $30,000.

VIRGINIA.

The Richmond Street-Railroad Company proposes to lay tracks on Ninth and Leigh avenues, and to extend the Main street line to the western limits. The council will not grant permission unless the company will undertake to build a line on Church Hill avenue to Church Hill and Oakwood Cemetery.

The Richmond & Manchester Railroad Company has petitioned for right-of-way on several streets, and proposes to build the line to Reservoir Lake, and a branch to the Soldiers' Home.

WISCONSIN.

At Green Bay, Wis., a street-railroad is to be built. Material will be required.

The Eau Claire Street-Railroad Company has been incorporated by H. H. Hayden, W. A. Rust and G. B. Shaw. Capital stock, $50,000.

The Ashland Street-Railroad Company has recently been incorporated with a capital stock of $50,000.

Manufactures.

THE ROGERS LOCOMOTIVE AND MACHINE WORKS.

(Continued from page 216.)

CHAPTER V.

THE ORGANIC DEVELOPMENT OF THE LOCOMOTIVE.

DURING the period of fifty years that has elapsed since Mr. Rogers first commenced to build locomotives in Paterson, not only has the machine as a whole been going through a process of evolution, as described in preceding chapters, but there has also been a development or adaptation of its various parts or organs, as they may be called, to the functions which they have to perform. A description of the different forms and methods of construction of these organs, which were adopted and in use at various times, will, therefore, become a sort of comparative anatomy of American locomotives. This may conveniently be divided into three parts—one relating to the boiler, another to the engines, and a third to the carriage or running-gear. These will be taken up in succession.

THE BOILER.

The boiler of the "Sandusky," the first engine built by Messrs. Rogers, Ketchum & Grosvenor, was substantially the same as that of the Stephenson engines, of what is known as the "Planet" class, that is, the top of the furnace was semi-cylindrical in form, and flush, or nearly flush, with the top of the barrel of the boiler. The horizontal section of the fire-box below the barrel of the boiler was square, or nearly so.

In 1837, Mr. Bury was made locomotive superintendent of the London & Birmingham Railway in England, which gave him an opportunity of adopting extensively on that line a class of engines, the original of which he introduced on the Liverpool & Manchester Railway in 1830. These were four-wheeled engines with inside cylinders, not unlike Stephenson's in their general plan, but the tops of the furnaces instead of being semi-cylindrical were hemispherical, and the horizontal section of the fire-box, below the waist of the boiler, was of a form approximating to the letter D, the flat part being in front. This form of firebox was adopted in the fifth engine built at the Rogers Works, and it was in continuous use until 1857, and is shown in Figs. 14 to 22.

A large proportion of the early locomotives built in this country, were built to burn wood. The Baltimore & Ohio Railroad was, perhaps, the only pioneer road that commenced by using coal for fuel, and even on that line many locomotives burned wood. As the weight of locomotives was increased and coal was substituted for wood, larger fire-boxes were required, and this led to the abandonment of the hemispherical-topped furnace, which was not well adapted to fire-boxes whose length was materially greater than their width, and the semi-cylindrical form which was first used, was substituted in its place. In these, the crown-sheets were usually stayed with crown-bars placed either lengthwise or crosswise on top of the fire-box.

At first the cylindrical tops of the furnaces were made flush with the tops of the barrels of the boilers, but this form was succeeded by what is known as the "wagon top" form of boiler, which was first used in the Rogers Works in 1850. The tops of the furnaces, in boilers of this kind, were also semi-cylindrical, but they were made considerably higher than the barrels of the boilers, as shown in Figs. 23 to 26. The exact reason for first adopting this form of boiler is not known, but it had the advantage of giving more steam room, and allowed the use of more tubes, and consequently more heating surface, than could be used in a flush-topped boiler. The wagon top also gives more room for workmen on the inside of the boiler, over the crown-sheets, and it thus facilitates construction and repairs. Mr. Hudson was always a strong advocate of this form, and he gave especial attention to

Fig. 27.

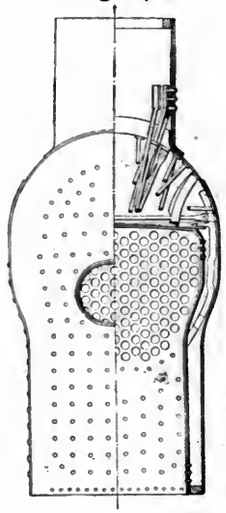
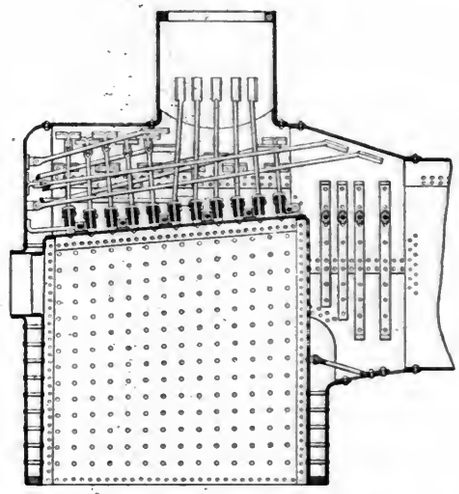


Fig. 28.



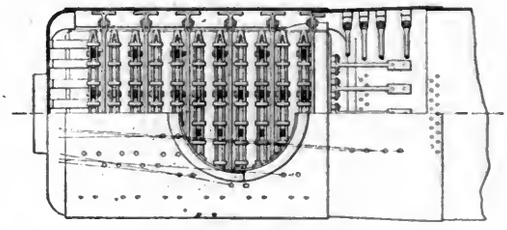


Fig. 29.

staying it, as is shown in Figs. 27, 28 and 29, in which the stays and braces are shown.

For burning anthracite coal, it was found that very long fire-boxes were required. In 1860, the form shown in Figs. 30 and 31 was built at the Rogers Works from the design of Mr. Millholland, of the Philadelphia & Reading Railroad. The top of this furnace sloped downward from the barrel of the boiler, and the crown-sheet was stayed with screw-stays, excepting for a short distance behind the tube plate. Water grates were used in this fire-box, and are shown in the engraving.

In 1861, some fire-boxes with long combustion-chambers and a water bridge, as shown in Fig. 32, were constructed for the New Jersey Railroad & Transportation Company.

In 1862, a fire-box with the water leg A, Figs. 33 and 34, was made for the Chicago, Burlington & Quincy Railroad.

The brick arch, Figs. 35 and 36, was used in 1865.

In 1871, some engines were built for the Cumberland Valley Railroad, with the Buchanan fire-box, shown by Figs. 37 and 38.

The form of the Belpaire fire-box, shown by Figs. 39 and 40, was applied to locomotives for the Matanzas Railroad of Cuba, in 1874.

The Belpaire fire-box has been extensively used on the continent of Europe, and within the past few years has been regarded with much favor by some of the leading master mechanics in this country, and it has been adopted on a number of railroads here.

The fire-box represented by Figs. 27, 28 and 29 is, however, the one which has been the most commonly used for engines built at the Rogers Works. It has stood the test of long experience, and is still regarded with much favor by engineers and master mechanics.

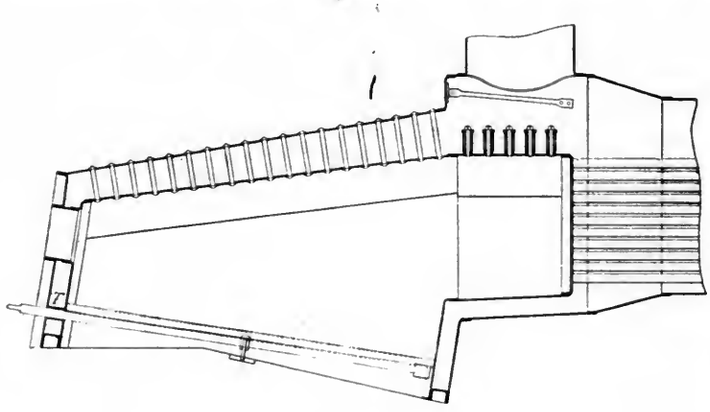


Fig. 30.

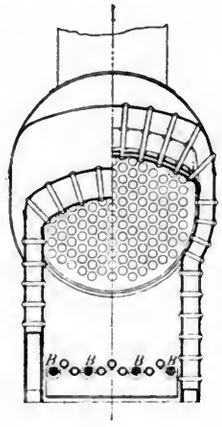


Fig. 31.

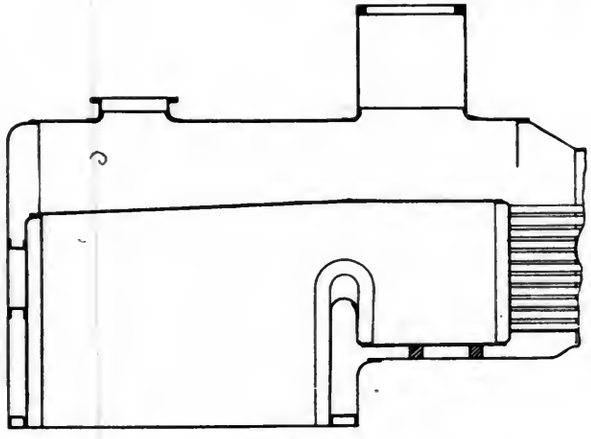


Fig. 32.

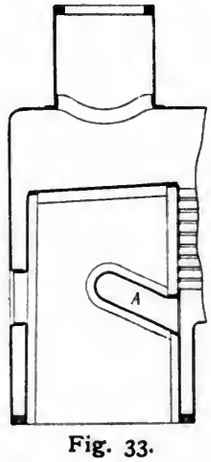


Fig. 33.

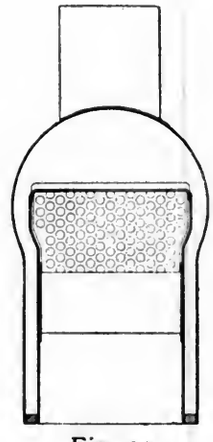


Fig. 34.

The form of brick arch shown in Figs. 41 and 42 was used in 1881. In this it will be seen that the fire-brick is supported on bent water-tubes, which are attached at one end to the crown-sheet, and at the other to the front plate of the fire-box. Another form of brick arch, supported on water-tubes, is shown in Figs. 43 and 44. This was used in 1885.

TUBES.

Very soon after coal was substituted for wood as fuel in locomotives, the use of copper and brass tubes was abandoned in this country, and iron tubes were used instead. At first there was a great deal of trouble in keeping these tubes from leaking. This was especially the case before steam gauges were generally used. Without these instruments it was impossible to tell what the steam pressure was, until the safety-valves commenced blowing off. They were, therefore, the principal guides by which the fireman was governed, that is, he would "fire" until "she commenced blowing off," and then he would open the furnace-door wide to cool the fire. The result was that the tubes were thus exposed to alternate currents of cold and hot air, and were thus continually expanded and contracted, which caused them to leak. With a steam gauge, however, a fireman had always a guide before him to indicate just what the steam pressure was, and could control his fire accordingly, and, therefore, was not obliged to open the furnace-door so often to regulate the steam pressure.

While the frequent expansion and contraction of the tubes probably caused them to leak, yet there can be no doubt that the methods of fastening them which were at first used were much less efficient than those which have since been adopted.

The manner of fastening tubes in 1837 is shown in Figs. 45, 46 and 47. The tube was inserted into the hole in the tube-plate, and a tapered mandrel, shown by Fig. 46, was driven into the end of the tube, so as to expand it to the full size of the hole in the plate. This mandrel was flattened on five sides, as shown in the end view, Fig. 47, After each blow on the end of the mandrel it was turned slightly so as to expand the tube equally all around. The end of the tube was then turned over, as shown in Fig. 45. which represents a longitudinal section of it. Probably some form of caulking tool was used for this purpose. A

wrought-iron thimble *T* was then driven into the end of the tube.

In 1840, the form of caulking tool shown in Figs. 48 and 49 was adopted. This was inserted in the end of the tube with the notch *A* bearing against the edge, which was then turned over by driving the tool against it with a hammer.

As already stated, thirty or forty years ago a great deal

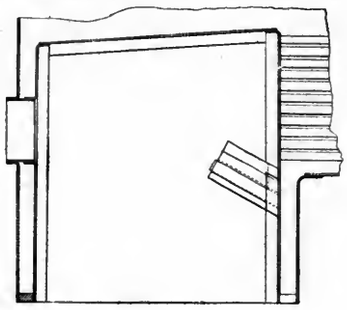


Fig. 35.

Fig. 36.

of trouble was experienced on locomotive engines with leaky flues. It was a constant source of annoyance, and every few days some one had to go into the furnace to hammer or caulk up the ends of the flues and thimbles (the flues at that time were either copper or brass, and the thimbles were of wrought-iron).

In 1850, Mr. Hudson, then master mechanic of the Attica & Buffalo Railroad, conceived the idea that if cast-iron thimbles were substituted for wrought-iron it would remedy this standing difficulty. Acting on this idea he

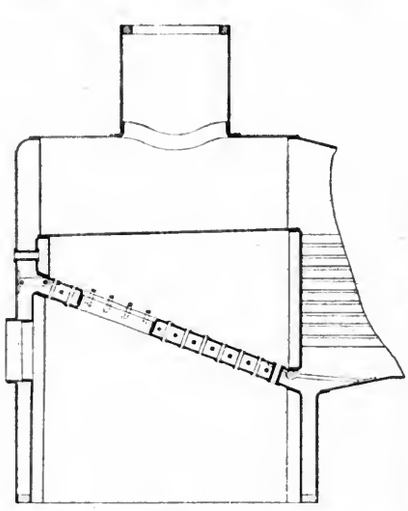


Fig. 37.

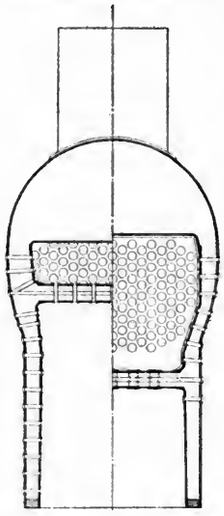


Fig. 38.

proceeded to verify it—first, by taking a thimble of each kind, wrought and cast-iron, turning them accurately to a gauge, then heating them red hot, measuring them, and noting the expansion of each; afterward cooling them in water and again measuring them. This process of heating, cooling and measuring was repeated twelve times, when the wrought thimble was found to be appreciably smaller in size than at first, and the cast-iron thimble larger. It was noticed that the former thimbles expanded more than the latter when red hot; this was anticipated.

To carry this idea into practice, a locomotive with leaky flues was taken; all the thimbles were taken out, the flues carefully expanded, and new thimbles put in. One-half, or all on one side of the center line of the flue-sheet, vertically, were of wrought-iron, and the other half were all of cast-iron. At the end of the first trip, when the boiler was cooling down, it was found that all the flues with wrought-iron thimbles were leaking, whereas, at the same time, all those opposite to them with cast-iron thimbles were tight. The wrought-iron thimbles were then taken out and cast-iron ones put in their places, when all stopped leaking, and so continued, the engine doing duty

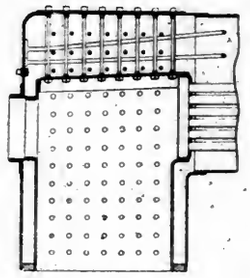


Fig. 39.

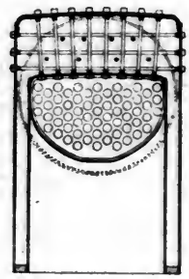


Fig. 40.

without any more trouble from leaky flues. The attention of Thomas Rogers was called to the fact, and he began to use cast-iron thimbles with a like result. Mr. Rogers called the attention of John Brandt, then in charge of the motive power of the Erie Railway, to the subject; he, also, immediately tried cast-iron thimbles, and found the result as stated above, and hence their use spread and became almost universal; few, except those who had experience in the matter at that time, can now realize how much annoyance and expense were saved by the change.

In 1861, tubes were fastened as shown in Fig. 50, that is, a copper end or thimble was brazed to the end of the tube, and a steel thimble was placed on the inside of it, so as to bring the copper between it and the tube-plate. The soft copper between the steel thimble and the plate,

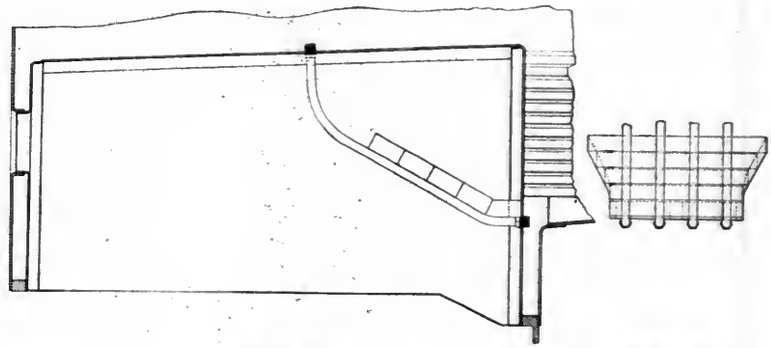


Fig. 41.

Fig. 42.

it was found, assisted materially in making and keeping the tubes tight.

In 1862, the method shown in Fig. 51 was adopted. In this the copper end was dispensed with, and a copper thimble was placed on the end outside of the tube, as shown.

The Prosser expander was first used at the Rogers Works in 1863. This is shown by Figs. 52 and 53. Fig. 52 is a side view with the end of the tube and plate shown in section at *A* and *A*. The expander consists of what may be called a plug composed of eight sector-shaped pieces, as shown in the end view, Fig. 53. These are held together by an open steel-spring ring *B*. In the center of

the sectors there is a tapered hole *C*, Fig. 53 (shown by dotted lines in Fig. 52), into which a tapered plug, Fig. 54, is driven. The open spring-ring permits the sectors to separate when the tapered plug is driven into the opening. The sectors each have a shoulder or projection at *S S*. These come just inside the tube-plate, when the expander is inserted into the tube. By driving in the tapered plug or mandrel, Fig. 54, the sectors are forced apart, and expand the end of the tube. At the same time, the shoulders *S S* produce a ridge in the tube, inside of the plate, which helps to keep the joint tight.

In 1867, the Dudgeon expander, shown by Figs. 55 to 58, was introduced. This may be described as a hollow plug which has three rollers, *R R R*, Figs. 55 and 56, which are contained in cavities in the plug, in which they can revolve, and in which they can also move a short distance radially, that is, from the center of the plug outward. When this expander is inserted in the end of a tube, a tapered mandrel, Fig. 57, is driven into the central opening, and it then bears against the rollers *R R*, and forces them outward against the tubes. A crank handle is then attached to the square end of the mandrel and it is turned around, which causes the rollers to revolve on their own axes. This causes the hollow plug to revolve around its axis. The two thus have a sort of sun-and-planet motion in relation to each other. As the rollers bear hard against the tube their effect is to elongate it circumferentially, and thus enlarge it so as to completely fill the opening in the tube plate. Usually, copper ferrules are used outside of the ends of the tubes. This method is the one which is now generally employed at the Rogers Works for fastening tubes in their plates.

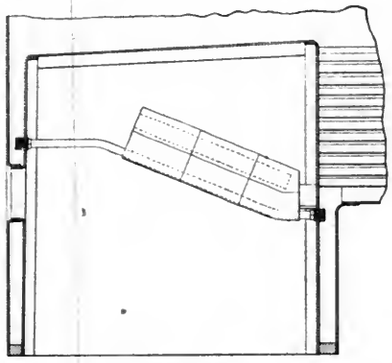


Fig. 43.

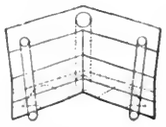
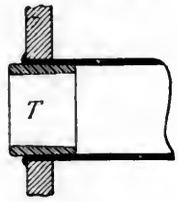


Fig. 44.

Fig. 45.



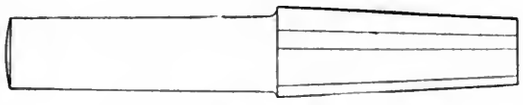


Fig. 46.

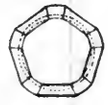


Fig. 47.

Fig. 48.

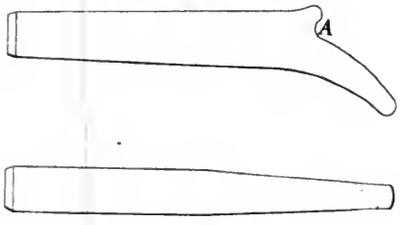


Fig. 49.

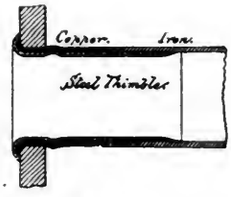


Fig. 50.

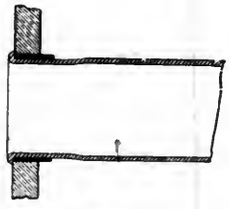


Fig. 51.

Fig. 54.

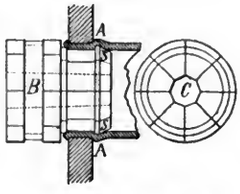


Fig. 52. Fig. 53.

Fig. 58. Fig. 57.

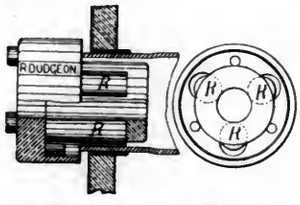


Fig. 55. Fig. 56.

FURNACE-DOOR.

In 1865, Mr. Hudson used the furnace-door deflector illustrated by Figs. 59 and 60. *D* is the deflector which is suspended from a hook *H*, attached to the fire-box over the furnace-door. A lever *L* is fastened to the deflector, by which it is moved out of the way when coal is thrown into the fire. The position of the deflector is regulated by the lever, and a latch *L* at its upper end. A pair of sliding-doors are used in connection with the deflector. These are opened by a system of levers, which are clearly

shown in the engravings. This was first suggested by a fireman in England, who found that, by inserting a scoop shovel upside down in the furnace-door, he could prevent smoke.

BOILER SHELLS.

In making boilers with iron-plates, Mr. Hudson always took great pains to have the plates of such sizes and proportions that the "grain" or fibers of the iron around the barrel of the boiler would be in the direction to resist the greatest strain. This practice is still continued in the Rogers Works when iron plates are used.

engraving of the "Sandusky," Fig. 12, was to rivet a circular casting, having a flange top and bottom, to the barrel of the boiler. The upper part of the dome was also made of cast-iron and was bolted to the top flange of the circular casting. A similar plan was also adopted when the domes were attached to tops of the hemispherical-shaped furnaces, as shown in Figs. 12 to 22. Even after the use of the hemispherical-shaped furnace was abandoned, cast-iron domes were still used, and, in some cases, the bases of the domes were made of wrought-iron. When the size of engines and their domes was increased

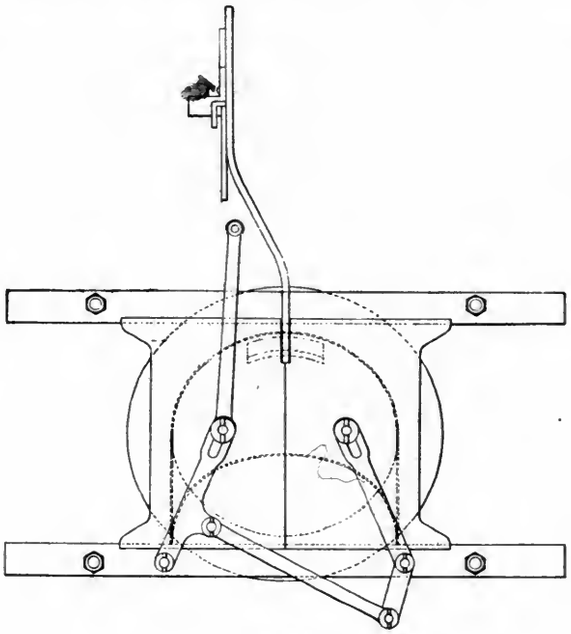


Fig. 59.

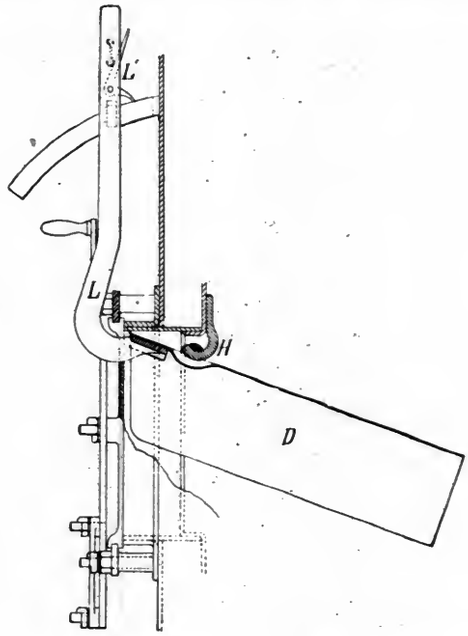


Fig. 60.

Fig. 61.

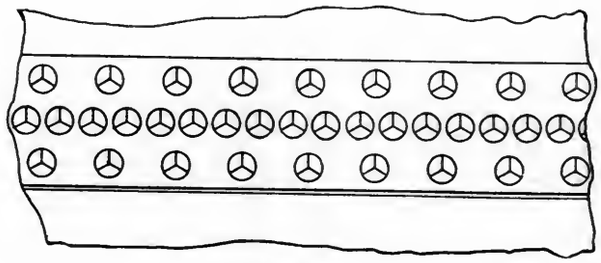


Fig. 62.

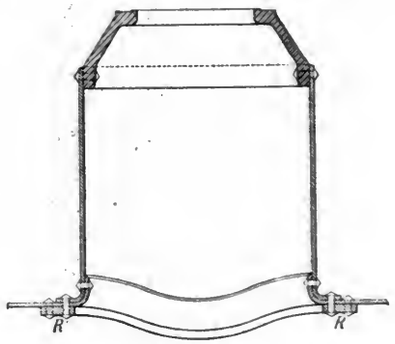


Fig. 63.

In 1852, he adopted the method of making the horizontal seams of boilers shown by Figs. 61 and 62. This consisted of an ordinary single-riveted lap seam, with a covering strip or "welt" over the inside, which was made wide enough to take an extra row of rivets on each side of the main row. The outside rows were spaced double the distance apart of those in the main row. The welts not only serve to strengthen the seams, but they cover the inside caulking edges where corrosion and "grooving," or "channeling," as it is called, is most likely to occur. By being covered, these edges are protected from the action of the water.

DOMES.

The first method of fastening domes, as shown in the

so much that it became impracticable and unsafe to make them of cast-iron, they were made of wrought-iron plates, with a flange at the bottom, which was riveted to the boiler shell, as shown in Fig. 30. Later, the boiler shell was flanged upward around the edge of the opening at the base of the dome, as shown in Figs. 26 and 27, in order to give additional strength at this point. The dome was then attached to the boiler with two rows of rivets. In 1880, a reinforcing ring, *R R*, was added at the base of the dome, as shown in Fig. 63. This serves to strengthen the boiler shell at the base of the dome, where it is weakened by the opening required to give access to the inside of the boiler.

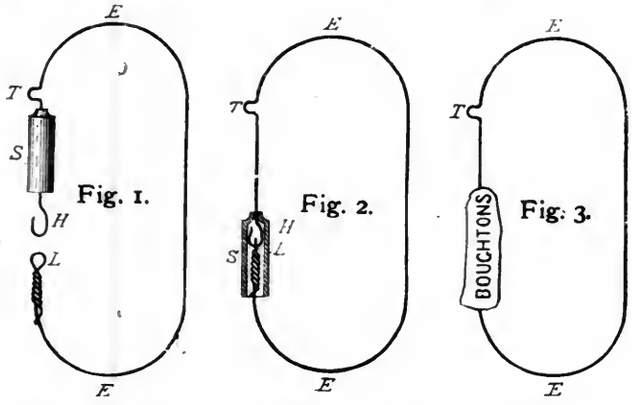
(*To be continued.*)

New Inventions.

Boughton's Seal for Freight-Car and other Locks.

THE engravings herewith, represent an improved form of seal which has recently been patented by Mr. Claudius V. Boughton, of Buffalo, N. Y. It consists of a length of wire E E, Figs. 1, 2, and 3, with a hook H at one end and a loop L at the other, with a cylindrical-shaped seal S, made of lead, which slips on over the hook and loop. In Fig. 1 the hook and loop are shown detached. In Fig. 2 they are connected together, and the seal, which is shown in section, is slipped down over the hook and loop. T is an off-set or bend in the wire to prevent the seal from sliding to the opposite end before it is used.

This seal is adapted for application to a freight-car lock as follows: One end of the wire E is passed through the slot of the hasp, the staple, and the padlock on the door. Then the hook H of the wire E is engaged with the loop L, and in such position the cylindrical seal S is pushed



BOUGHTON'S SEAL FOR FREIGHT-CAR AND OTHER LOCKS.

over the united ends, as clearly shown in Fig. 2. When the parts are thus arranged, they are placed between the jaws of a pair of pinchers or other suitable instrument, and the lead seal is compressed until it assumes the flat shape shown in Fig. 3. When the seal is thus compressed, the united hook and loop of the wire are completely embedded in the lead seal, and cannot possibly be separated or withdrawn therefrom without such a complete mutilation of the seal as to render it impossible to restore it to its normal, flattened condition. In forming the disk-shaped seal now in general use it presents a burr centrally arranged around its periphery. The presence of this burr renders it possible to cut the seal upon the line of the burr, loosen and remove the wire, and restore the seal so nearly to its normal shape as to escape detection from a casual inspection of the seal. With this improved construction, such tampering with the seal is practically impossible.

It is apparent that these improved seals are adapted for other uses than that of sealing freight-car locks—such as mail-bags, safety-valves, liquor cases, oyster tubs, etc., etc. They are manufactured by the Buffalo Seal & Press Company, of 436 Niagara street, Buffalo, N. Y., lately incorporated under the laws of the State of New York. The company is manufacturing 30,000 seals per day at the present time, and is increasing its machinery in every department.

Hartmeyer's Improved Water-Cooler.

THE accompanying engravings, Figs. 1 and 2, represent an improved water-cooler, the object of which is to provide separate and independent receptacles, in order to prevent the too rapid waste of ice, and also to prevent the water from becoming impregnated with any impurities in the ice. One of the engravings, Fig. 1, is a perspective view showing the outside of the cooler with the lid open, and Fig. 2 is a longitudinal section.

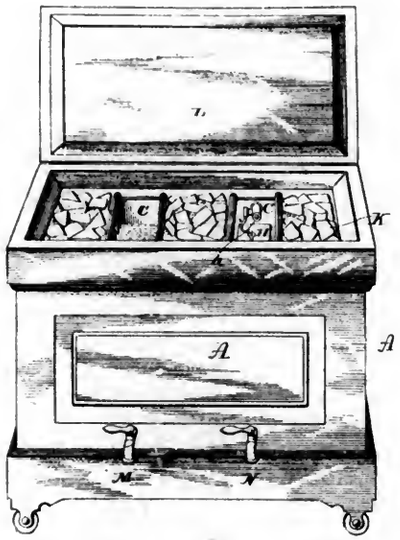


Fig. 1.
HARTMEYER'S IMPROVED WATER-COOLER.

A represents a chest constructed with double walls *a b*, which are separated so as to leave an intervening space between them, which is filled with any suitable non-conducting material.

The inner wall *b*, is made of galvanized iron or other suitable sheet metal.

Within the chest A, are located one or more water-

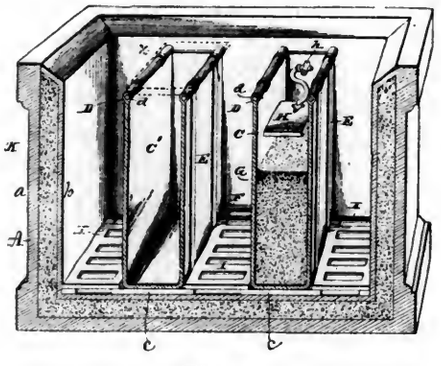


Fig. 2.
HARTMEYER'S IMPROVED WATER-COOLER.

receptacles C C'. In the accompanying drawings two are shown. They consist, preferably, of a single sheet of metal bent U-shaped, to form the sides and bottom of the receptacle, and flat sheets of metal secured to the edges of the sides and bottom to form the ends; or they may consist of granite, agate, porcelain, or enameled ware. The receptacles C are located at about equal distances from the ends of the chest and from each other, and are supported above the bottom of the chest upon cleats *c*. They are also further supported by rods D, which extend

through sockets *d*, in the upper side edges of the receptacle, and transversely through the chest-walls, and are secured in position by nuts. To prevent the sides of the water-receptacles from bulging out, vertical strengthening-ribs E are secured thereto, as shown. The water-receptacles C are provided with covers *x*, to prevent the dirt from falling in when ice is placed in the chest.

The hinged cover B is provided with beveled outer edges *h*, which fit correspondingly-beveled edges *i*, formed on the upper edge of the chest, and thus insure an air-tight joint when the cover is closed.

The receptacles C communicate with each other through one or more pipes, as F. The receptacle C, into which the supply of water for the several receptacles first runs, is provided with filtering material G, either in bulk, as shown, or in a separate receptacle, which may be taken out and renovated without disturbing the water-receptacle. A float H is connected with the stop-cock *h* in the supply-pipe, and is adapted to close the cock when the water in the receptacle rises to the proper height, and to open the cock as the water is drawn from any one of the receptacles, thereby automatically regulating the supply of water in the cooler.

Between the water-receptacles, the bottom of the chest A is provided with raised grates or slots I, which hold the ice above the bottom of the chest and form a drip-reservoir for the water from the melting ice.

K represents the ice packed in the chest between the water-receptacles.

L represents the lid of the chest, and M and N represent, respectively, the draft-faucet for obtaining drinking-water, and the water-faucet for cleansing the receptacle containing the filtering material.

By the above construction, the water, gradually entering and flowing through the filtering receptacle, becomes thoroughly cooled before it is drawn for use, while the automatic supply prevents annoyance from carelessness or forgetfulness on the part of the person entrusted with its care, and the distributing of the water into several receptacles brings it into more extended contact with the ice-cooled surface.

The independent construction of the receptacles admits of their removal for repairs or cleansing, while the inner wall of the chest remains intact.

It will be observed that the ice cannot come in contact with the water, and, therefore, the water is not charged with any impurities in the ice. Again, the water is maintained at an even temperature, owing to the fact that the sides and bottom of the water-receptacle are subjected to the uniform and constant temperature of the ice. Further, a water-cooler constructed in accordance with our invention insures great economy in the use of ice, as the latter is kept insulated from the water, and will not melt away so rapidly as if it were immersed in the water; and owing to this fact it requires much less labor and attention in the care of the water-cooler, as it will remain cool and not require to be refilled for quite a long period of time.

Further information concerning them can be obtained by addressing John Hartmeyer, Zanesville, Ohio.

Wooley's Car-Coupling.

THE engravings herewith represent some improvements in Wooley's car-coupler, of which illustrations were published in the September number of the JOURNAL. In the engravings herewith A is the end and frame of the car; B, the draw-head, which is attached as usual. *b* is the under lip, which is beveled or curved. *b'* and *b²* are the upper and lower slots in the draw-head. D is the coupling-pin, the head of which is flattened to pass between the jaws of the operating-arm E. G G is the operating-shaft, with an arm *g* in the middle, and which is connected by a link H to ears on the operating-arm E. *g'* is a lever or arm, attached at the side of the car to the shaft G, to turn the latter, by which the uncoupling and guiding of the link is effected. M is a clutch which engages with *g'*, and thus locks the shaft G in a position which holds the coupling-pin up, to prevent coupling when pushing cars. When the clutch is thrown back, in the position shown by the dotted lines, it leaves the arm *g'*, the shaft G, and the coupling-pin free to couple. K is a chain to connect with the arm *g'*, for the purpose of locking it when the car is coupled. N is a chain attached to the arm *g*, and extending to the top of the car, to enable an operator to uncouple from that position.

The inventor's address is C. D. Wooley, Walden, N. Y.

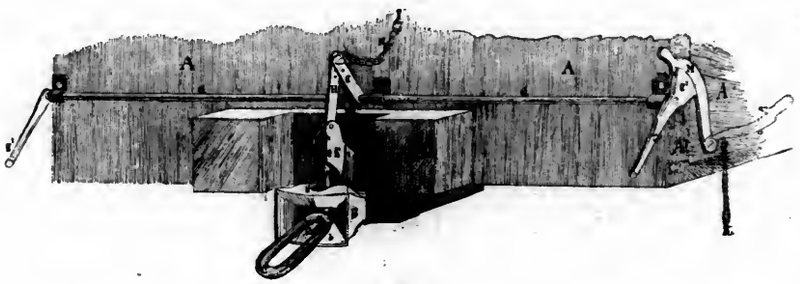


Fig. 1.

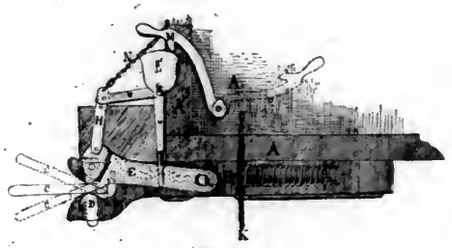


Fig. 2.

WOOLEY'S CAR-COUPLING.

American Railroad Journal.

WHOLE NO. 2,583.] NEW YORK, DECEMBER, 1886. [VOLUME LX.—No. 9.

THE WORLD'S FUTURE FUEL.

THE DAYS OF COAL STOVES AND ASHES SAID TO BE NUMBERED—PULVERIZED COAL AND ARTIFICIAL GAS, AND THEIR ADVANTAGES—REPORT ON THE SUBJECT FROM THE SCRANTON BOARD OF TRADE.

THE Scranton Board of Trade recently published a report on the anthracite coal industry, which takes a roseate view of the future of the fuel question. Properly assuming that the welfare of the human race depends largely on its skill in obtaining artificial heat and power, the report argues that the deposits of anthracite in Pennsylvania are destined to be the chief source from which mankind, in North America at least, are to be supplied with comfort.

In order, however, not to exhaust the supply prematurely and unnecessarily, improved methods of utilizing this coal must command the attention of the country. To two of these improved methods the report is largely devoted. That the present method of using coal, or indeed any kind of solid fuel, is wasteful in the extreme has long been maintained by scientific investigators. In the general utilization of coals only from 10 to 25 per cent. of possible heat is made available. If this claim is well founded, the field for invention in the direction of greater economy in the use of fuel is certainly inviting. The two improved methods discussed in the report under consideration consist of burning coal in a pulverized state, and in using it for making fuel gas.

Pulverized coal has been used for some time in a few localities, it is claimed, with entire success. The National Armory in Springfield is one of these places, this method of consumption having been introduced there in 1883. The coal is reduced to a powdered form so fine that it will float in the atmosphere, and it is carried into the burning furnace by a current of air artificially produced. In the powdered form everything is consumed, making no smoke, and leaving no ashes. Machinery for pulverizing the coal has been brought to a satisfactory stage of perfection, and it is claimed to be both economical in use and comparatively inexpensive in construction. By pulverizing the waste coal at the mines, culm and screenings can be used up clean. As there are mountains of this waste now on hand, its use for pulverizing will effect an important saving of the original deposits.

The heating powers of pulverized coal are thus stated by Charles E. Emery, of New York, as quoted in this report of the Scranton Board of Trade: "The finely divided combustible, being kindled by the flame drawn from the fire-boxes, burns in the descending current with great energy, and from the comparatively large surface exposed to the action of air generates a great amount of heat, and, with an excess of fuel, an intense light. The great fiery blast, nearly filling the tower (of a blast furnace) can, at pleasure, be made oxidizing or reducing in its action by regulating the supplies of fuel and air. I have seen it, at twelve feet from the top, so potent as to heat rapidly to whiteness two feet of a wrought-iron bar an inch in diameter, and cause it, though supported at both ends, to bend like wax beneath its own weight in thirty seconds after it was placed in the blast." For blast furnaces, for great forges, for generating steam, and for all purposes of obtaining power and heat for mechanical purposes, pulverized coal is certain to come into use, it is claimed, because of its greater effectiveness, and its vastly greater economy.

But pulverized coal, superior in every respect as it is as compared with lump coal, is manifestly a crude, cumbersome fuel compared with water-gas fuel. On this subject the committee who prepared this Scranton Board of Trade report is very enthusiastic. The process of making the gas, its component parts, and the economies of using it are set forth with a good deal of particularity. Water gas is, of course, no new product, but the process of making it has been so expensive as to bar it out from the competition for cheap fuel. Late inventions have cheapened its manufacture so that it can now be put into general use, it is claimed, with assurance to the consumer that his fuel for all purposes of generating power, of warmth in his apartments, and of cooking his food will be cheaper than solid fuel, while he will be rid of the annoyance of handling coal, of carting away ashes, and of having his apartments soiled by dust.

On the authority of Prof. T. S. C. Lowe, who has been foremost in bringing the processes of making cheap fuel gas to their present stage, it is claimed that one ton of anthracite coal will suffice to generate from 50,000 to 100,000 cubic feet of gas. The average of 80,000 cubic feet is used in the calculations of the Board of Trade report, but the maximum number, 100,000, can be reached with properly constructed apparatus. The cost of the gas is, on this basis, and after making due allowance for cost of plant, estimated at nine cents a thousand cubic feet. When this gas is brought into general use for fuel, as the Scranton report considers to be certain, the cost of it to consumers will necessarily vary according to circumstances; but the cost of manufacturing it for a given consumption is not at all problematical, even with appliances so far secured for making it. In the city of Troy, N. Y., a water-fuel gas plant has been in operation since midsummer. It is the only one, it is believed, in this State. The supply is to the laundries with which the city abounds, to the collar factories for power, and to hotels, restaurants, and private houses for heating and cooking. The cost of making the gas at this plant is said by the managers to be about ten cents a thousand cubic feet,

and the charge to consumers is fifty cents a thousand cubic feet. It is used in gas stoves and heaters that are comparatively inexpensive, because they are simple contrivances which give no trouble in their management. The gas furnished is non-luminous, the blaze resembling that from alcohol. It is, however, intensely hot. A common nail held in the blaze of a jet with a pair of tongs will be heated to a white heat in a few seconds. The gas has no odor.

The process of manufacturing and using this fuel is claimed to be already so nearly perfect as to assure its rapid introduction to use, while a tempting offer is thrown out to the public in the way of cheapness and convenience. The committee of the Scranton Board of Trade are refreshingly sanguine on this subject. "The contemplation of the gas subject in the anthracite coal fields," they say, "is almost like an Aladdin story. In scientific nomenclature, it may properly be designated as anthracite gas." They make an estimate that brings the cost of manufacturing this gas down to less than two cents a thousand cubic feet. If the cost of making and distributing it to consumers can be brought to ten cents a thousand, the cost to consumers can be so low as to drive out solid fuel. The inducement to capital to undertake the introduction of this kind of fuel is set forth in estimates made by Prof. Lowe, who is the inventor of the improved methods of manufacture. He says: "The advantages of the gas over coal would enable the consumers to pay an average of 40 cents per thousand cubic feet for the gas, which would then be to them as cheap as other fuels. At this price it would be equal (to the manufacturers) to selling coal at $32 per ton, and at 30 cents per thousand cubic feet to the consumer, $24 per ton." Prof. Lowe truly remarks that here is a margin large enough to pay satisfactory dividends on all investments necessary to supply good-sized villages and cities. Further he says: "One thousand cubic feet of gas per day to each ten inhabitants for manufacturing, domestic heating, cooking, and lighting, is a low estimate; nevertheless, at this rate a city of 50,000 people would consume 5,000,000 feet daily, which at 40 cents per thousand feet would be $2,000 per day gross income, to produce which would require sixty-three tons of coal and the labor of ten men, besides bookkeepers, collectors, and officers, the expense of which is easily figured."

The vision of the Scranton committee, as shown by their report, rests finally on a project to make this water-gas fuel in the very mines of the anthracite deposits, piping it thence for consumption; in other words, taking up the hint nature has dropped in the shape of natural gas, these sanguine gentlemen see the possibility of going under ground for the purpose of continuing the supply of gas by artificial means when the natural supply fails, and of competing with the natural supply if it does not fail.—*New York Evening Post.*

Compound Locomotives.

(From the English Mechanic.)

THOSE of our readers who are interested in the subject of compound locomotives will, when the transactions of the Institution of Mechanical Engineers are published, have an opportunity of consulting two remarkable papers, one of which—that of Mr. Alexander Borodin, of Kieff—is almost a volume in itself. Mr. Borodin is connected with one of the Russian railways, and, in 1880, altered a locomotive to the compound system adopted by that distinguished advocate of the type, M. Mallet. The cylinders were in the proportion of 1 to 2, and, practically, the locomotive would cost no more to build than one of the ordinary type. The cylinders were jacketed, and, for comparison, one of the locomotives of the usual type was also fitted with jackets. Both engines were tested with experimental trains, and were subsequently jacked up in a shed and used to drive a machine-shop. All sorts of experiments seem to have been made with steam at various pressures and with different degrees of cut-off, with steam in the jackets and without. As a result of the trials, Mr. Borodin concludes that with the same expansion of steam the consumption of water and of fuel is less in a compound locomotive than in a simple engine, and, as that is the gist of the whole question, it might be considered that it would be better settled by a comparison between locomotives in actual work. As to the question of jacketing, it must be remembered that a very great deal depends upon how the jacketing is done, and it seems clear that in the case of Mr. Borodin's engines the arrangements for draining the jackets were not all that could be desired. However, the following conclusions were arrived at: When the jackets are not in use, the compound engine gives, in comparison with the ordinary engine, an economy of 13 per cent. in consumption of steam, and of 24 per cent. in consumption of wood. Admission of steam into the jackets does not sensibly affect the consumption of steam in the ordinary engine; whilst in the compound engine it produces an injurious effect, and increases the consumption of fuel and water per indicated horse-power. In summing up the results of his inquiries, Mr. Borodin says:

"The steam jackets on the ordinary engine, while working in the testing shed in the first and second notches, undoubtedly gave a mean economy of steam of 16 to 13 per cent. In the experimental trains the jackets did not generally give satisfactory results, except when the ordinary engine was working in the first notch; but this must be attributed partly to the losses of steam necessary for warming up the walls of the jackets each time the regulator was opened, and above all to the defective drainage of the jackets, which probably transformed them into condensers." All experience has taught makers—especially of portable engines—that unless jackets are properly drained they are worse than useless, and Mr. Borodin is probably of that opinion; indeed, he said that a better method must be sought for with regard to the compound system. He says that "it undoubtedly gave an economy in water and fuel varying from 15 to 20 per cent.; an economy which, if it can be maintained in practical work, will be found of considerable importance in localities where fuel is dear, and water scarce and bad." Mr. Sandiford in his paper gave an account of the working of compound locomotives in India, in the shape of data connected with two compounds of different patterns. One of these engines has two cylinders, respectively 18 inches and 24 inches in diameter, with a stroke of 22 inches, and an arrangement for admitting steam direct to the low-pressure chest; and that engine worked satisfac-

torily with a saving of 13½ per cent. of fuel as compared with an ordinary coupled engine having cylinders 16 inches by 24 inches. The other locomotive has four cylinders; two of 11¾ inches outside, and two of 17 inches inside, with a 24-inch stroke. This pattern heads the list for economy of fuel, although the pressure of steam used (120 pounds) is not sufficient, in Mr. Sandiford's opinion, to develop the full benefit of the compound system. M. Mallet, although he has made other designs, prefers a compound with two cylinders only, when the low-pressure cylinder can be made large enough; but where that is impossible it is best, in his opinion, to have four cylinders. It is not unlikely that the whole question will be discussed fully on a future occasion, as from the nature of the late meeting the actual results shown by Mr. Borodin's tables could not be carefully criticised.

Maintenance of Permanent Way.*

As a result of experience with iron sleepers, increased attention has of late been given to the condition of the ballast. Lengths of ballast of medium quality, in which wooden sleepers appeared to be dry, have proved unsatisfactory with iron sleepers. By means of their pumping action the latter draw the wet up from below and work the ballast up into mud, making a solid bed impossible. This working up into mud occurs also with wooden sleepers, but only after the ballast, having become perfectly impermeable for water, requires renewing.

The reasons to this difference may be stated as follows:

1. The iron sleeper has twice the deflection of the wooden one.

2. On account of the accurate fastening of the rail to the iron sleeper it shares the whole vertical motion of the rail, whereas with wooden sleepers the play of the foot of the rail in the dogs, and the compressibility of the timber, both tend to lessen the deflection of the sleeper.

3. The hollow body of the iron sleeper is very favorable to the formation of an air-tight cavity, inducing the pumping action above referred to.

4. The under surface of the wooden sleeper lies twice as deep as that of the iron one.

The working up of the ballast into mud by iron sleepers, on certain trial lengths, has interfered with their more general introduction, whereas the failure should have been put down to the inferiority of the ballast, and its impermeability to water. It would be found that in similar ballast there is wet at the bottom of wooden sleepers. These considerations lead to the question—Is enough attention given in Germany to the nature of ballast in the construction and maintenance of railways?

The free-lying ballast introduced by Stephenson on English railways is now the universal rule in Germany, the old German system ("Koffer system"), or curved-surface system, being entirely superseded; but not only in the form, but also as to the material of the ballast, the English chose right at first,

Very little broken stone is used for ballasting German railways, as is shown by the prices of ballast as taken from "Statistics of the Railways of Germany," and given in the following table:

Date.	Price per cubic yard. Average.	Maximum.	Minimum.
	s. d.	s. d.	s. d.
1881-2.....	1 5	4 8	0 3
1882-3.....	1 5¼	4 7	0 3¾
1883-4.....	1 5	5 0	0 3

The bulk of the prices range between 9d. and 2s. 3½d. per cubic yard; this shows that there cannot be much broken stone used, the bulk of the ballast used being land and river gravel, sand, or cinders. The advantages of the use of broken-stone ballast are not as yet appreciated in Germany, the ballast material being chosen on account of cheapness in first cost. The author considers that broken stone is to be preferred to gravel in all cases. Good ballast must fulfill the two following conditions:

1. It must be capable of being beaten up under the sleeper into a firm mass, so as to afford the greatest possible resistance to the deflection when the load comes upon the sleeper, and also the greatest possible resistance to shaking loose.

2. At the same time the material must be such that between the sleepers there may be among it interstices for the passage of water, but also the greatest possible cohesion and friction to prevent slipping, and to distribute equally the pressure of the load.

Broken stone fulfills the conditions in a much higher degree than gravel. There is much more friction between the various angular fragments of the broken stone than between the round pebbles of gravel, and on this account the broken stone, when once beaten up, retains its place better than the gravel, which constantly shakes loose. No doubt, a firm bed for the sleeper is more easily obtained in the first instance with gravel, as the small stones and sand fill up the interstices between the larger ones; but this is far outweighed by the great advantage of the superior drainage resulting from the use of broken stone.

It is usual in Germany for the ballast to be laid to not more than 10 inches below the underside of the sleepers. With gravel ballast this is too little, as, owing to capillary attraction, the water stands in the gravel and also drains off very slowly. The depth should be 12 inches to 14 inches below the bottom of the sleeper, according to the nature of the formation. Usually, no attention is paid to this, the thickness of ballast being uniform throughout, whereas the line stands much better when the formation is permeable than when it is not, however excellent the drainage may be.

The author considers that instead of the ballast being renewed when the line is relaid, as is now usually the case, the lower portion of it being then choked with fine matter and impermeable, it should be kept constantly clean by being, from time to time, opened out and screened, the fine matter being removed and the coarse replaced, the deficiency being made up with new material. This method would be more in accordance than is the present with the principle that ought to guide permanent way maintenance—namely, that every part of the permanent way must always be kept in a condition answering to its function, the maintenance being prospective and continuous.

* Institute of Civil Engineers—Foreign Abstracts.

New Industrial Enterprises.

(From the Report of Consul Brent.)

THE event of the year, in relation to the proposed development of Peruvian resources, and the consequent improvement of all general and individual interests, is assuredly the contract entered upon by the government for the prosecution of the Oroya Railway works, and the exploitation of the Cerro de Pasco silver mines. Mr. Michael P. Grace, a member of the firm of W. R. Grace & Co., of New York, presented a carefully prepared proposal to the government of Peru, offering, under certain conditions, to prolong the famous Oroya Railway from its present terminus at Chicla, 79 miles from Lima, to the town of the Cerro de Pasco, 135 miles farther in the interior, and, in return for valuable concessions, build and establish at the great mining center the necessary plant for working the mines, and more especially for the drainage of those submerged shafts which have been unattainable since the year 1824, notwithstanding the many efforts that have been made to disclose their hidden treasures. The failure of these attempts may be attributed to the immense obstacles in the way of transporting to that remote district the requisite and heavy machinery employed in pumping out the shafts, as all had to be carried on mule-back, and this means of transportation proved to be inadequate. The Grace contract overcomes this difficulty. From Chicla, at an altitude 12,200 feet above the level of the sea, the railway line is run on to the pass of the Oroya, to which point nearly all of the earthwork is completed, passing through the Galera tunnel at the summit, 15,645 feet above sea level (this tunnel is already perforated), and then passing over a comparatively easy country for 85 miles until the Cerro de Pasco, 13,200 feet above the sea, is reached. With railway communications established, the question of erecting the stamp mills and completing the adit for the drainage of the mines is one easy of accomplishment, and, with the £3,000,000 of capital at the disposal of the syndicate of which Mr. Grace is the representative, there can be no lack of financial support. Work will be commenced on this undertaking at the earliest possible moment after tranquility is restored to the districts through which the railway must pass. Cargoes of material for the enterprise are already arriving at Callao, one of the first being a shipload of redwood ties from California; the surveys are all perfected, and peace is the only requirement wanting.

The Cerro de Pasco silver mines, during the Spanish rule on this coast, were only second in fame and importance to those of Potosi in Bolivia, and, according to the colonial reports, produced upwards of $400,000,000 in ore up to the beginning of the present century. Scientific engineers and experts, brought from abroad especially to examine and report on these deposits, unanimously declare that their wealth is incalculable, and only drainage and cheap transportation are required to bring them back to their former bonanza. When being worked, mostly on account of the king, and by the enslaved Indians of the interior, the production was effected at small cost.

By the Grace contract and arrangements with the guild of miners, which possesses certain privileges in the premises, the contractor is entitled to a large percentage of the new metals to be discovered in the course of exploration, and, of course, the ore at the bottom of the submerged shafts will enrich the contractors.

The Marchant Engine.

THIS system of engine is described as follows in a circular issued by the Marchant Engine syndicate: "A steam feed is returned to the boiler, thus preventing the loss of a large proportion of latent heat, as caused in ordinary steam engines in condensation, or other waste of steam. Mr. Marchant takes off two-thirds to his pumps after it has done its work in the high-pressure cylinder, and passes onwards one-third of the steam to the low-pressure cylinder, where it is expanded to the point of the attained vacuum action. The two-thirds of steam already mentioned as taken off to the pumps is expanded in them for the purpose of power to the engine. The one-third steam, passed to the low-pressure cylinder after it has done its pressure work, there exhausts into the vacuum, which is maintained in a surface condenser, and by its final condensation supplies the water required for the process operation. The steam to the pumps, after its expansion to power in them, is on every return stroke compressed into the one-third, supplied as water from the surface condenser by the exercise of engine-power, and all that is required over the steam pressure *which remains after the expansion in the pumps* is a further expression of power which shall be greater than that difference of gravity, which originally separated the steam from its water. The return of the two-thirds steam and one-third water to the boiler is effected by the air-spring, a most important part of the invention, which gives back on the return stroke the pressure expressed on the forward or compressing stroke, *i. e.*, the steam enters its liquid without increasing its pressure, whilst the added pressure to the air is communicated by the piston and forces the charge forward, both steam and air acting under the law of 'Physics,' which teaches that 'the total pressure is equal to the sum of the individual pressures,' the air-spring giving back again the power communicated to it. Under such process, the expansion of steam in the pumps adds to the power of the engine without drawback, whilst that pressure left in the steam after its final expansion in the pumps has given out power in the pumps on one side of the piston, and has been compressed into its water by a little over this expression of power on the return stroke, all deficiency of pressure in the steam to open the loaded valve forward to the boiler being added by the air-spring, so that the steam in its final stage gives out to power in the pumps the same pressure which has on the return stroke to be put into it, and the air spring gives back in the pump on the return stroke the same pressure as had previously to be put into it, and the charge is, as it were, swung back to the boiler. Indeed, without the air-spring no motion of the engine is attainable. The result of such action is that two-thirds of a pure caloric action is obtained."

The Brush Motor.

THE Brush Electric Company are manufacturing at their Cleveland works an electro-motor, which is electrically the counterpart of the well-known Brush dynamo. The regulation is effected mechanically by a somewhat

novel method, which is described as follows: "A centrifugal governor is provided, consisting of a metallic shell securely bolted to the armature shaft. To the inner periphery of the shell are pivoted on opposite sides of its center two governor arms, the inner and free ends of which are connected to the opposite arms by spiral springs. On each of the arms are placed adjustable weights. To the arms near their free ends are pivoted links, the opposite ends of which are connected to the commutators; the latter are set loosely on the armature shaft. As the governor shell rotates with the armature shaft, carrying with it the parts described, the weights will, at a certain speed, be moved by centrifugal action towards the periphery of the shell, and through the medium of the connecting-links will impart a rotary adjustment to the commutator, varying its position in the armature shaft. When the motor is at rest, the spiral springs will retain the weights in close proximity to the shaft and the commutator, at the extreme limits of its rotary adjustment in one direction, and the brushes will bear on the maximum points of the commutator. When current is switched into the motor, rotary motion is imparted to the armature and its shaft, the speed of which gradually increases until it has attained its normal velocity, when the governor weights will begin to recede from each other, and rotate the commutator on the shaft carrying its maximum point away from the contact of the brushes. This action decreases the effect of the current until a point is reached where this effect is balanced by the load on the motor, and the speed remains constant. On the other hand, should the speed of the motor be retarded by an increase of current or an increase of load, the governor weights will be drawn towards each other by the spiral springs, and thereby rotate the commutators in the opposite direction, the effect of which is to move the maximum points nearer to the brushes, and thereby increase the speed. The direct connection of the governor with the commutator would seem to ensure prompt adjustment of the latter without loss of motion, and at a minimum expense of power."

Automatic Couplings in England.

A CORRESPONDENT of the *London Times* says, that on more than one of the lines in the United Kingdom there are engineers who dogmatically assert that on English railways automatic coupling is practically impossible, and who further refuse to believe that any mechanical operation of joining links and present draw-hooks without men between the wagons can succeed, and he confesses that all past experience within the range of their observation justifies their conclusions.

He proposes that invitations should be issued to say, ten principal English railways, five Scotch railways, and three railways of Ireland, for the boards of directors to each delegate an official specially concerned in the working of miscellaneous traffic, to confer on a given date with the Board of Trade on safety couplings on the following plan: That from these delegates it is proposed to elect a committee of the companies' delegates for the purpose of drawing up a detailed list of the requirements of railway build and traffic combinations which safety couplings must provide for, to settle the particulars of and to what extent alterations, if any, of existing wagons or fittings, etc., can be permitted. That this list will be published under the authority of such committee, and that they will proceed to draw up rules for a comprehensive public trial by which every competing coupling should be tested and worked, and their actions and the results carefully recorded by identical tests and conditions executed on the same rails, points, crossings and tangents, and, as was done at the recent coupling trials in America, let each apparatus be photographed, at the same angle, on the same spot, and at the same height and distance from the camera, so as to be depicted as it is.

The writer goes on to say—and it is as true of this country as of England—that, "isolated action is hopeless. In the working of goods in this county, there are at least thirty types and varieties of vehicles, each of which in its different dimensions, or fittings, or pattern of fittings, introduces elements of difficulty to the inventor, while the innumerable combinations in traffic complicate the problem amazingly; in fact, so little acquaintance with this have the majority of inventors, that it would be quite possible to secure a decided verdict in favor of a particular invention as worked out on one railway, only to find it prove fatally dangerous to manipulate on another."

On Combustion, With Special Reference to Practical Requirements.*

IN all heating operations, the main object is to produce the greatest amount of effective work, with economy of fuel material and labor. In order to do this, it is of the utmost importance that combustion should be as perfect as possible. This, however, would not alone, in all cases, meet practical requirements; the form dimensions of the furnace and many other points having also to be considered. This paper was in many respects similar to that read by the author two years ago, before this Institute, in which he described a method of working regenerative gas-furnaces by employing radiant heat alone within the heating chamber, and drew attention to an important point connected with combustion, namely, that a flame requires free space for development, if it is to burn properly and effectively. He then showed from results obtained in practice, that a flame burning within an enclosed space should be directed so that whilst in active combustion it does not come into contact either with the sides or roof of the furnace, or with the materials contained therein, as when flame is allowed free space in which to burn, and is not interfered with by solid bodies, not only is there an increase of the work performed, but that work is accomplished in a better manner, and a considerable saving of fuel, furnace material and other advantages are realized. Since that time, this system of applying radiant heat, which it is now preferred to describe under its more general term as heating with free development of flame, has been largely adopted, and the author's theoretical investigations have been born out by the results of practical experience.

The theory which best explains the nature of flame is the one under which it is regarded as a rushing together of gases, the molecules of which being chemically excited,

* From a paper read by Mr. Frederick Siemens, published in *The Engineer*, October 15th, 1886.

are in violent motion towards or against one another. Such motion is a primary condition of combustion, which could not take place without it, so that anything interfering with the motion of the gaseous particles prevents that chemical union which exhibits itself as combustion. In order to insure perfect combustion, the following means have to be adopted: (1). The gases must be supplied in the exact chemical proportion in which they are required for combustion. (2). The gases must be brought together in such a manner that the different molecules which have to enter into combination may readily do so. (3.) Everything must be avoided which might interfere with the motion of the gases while combustion is proceeding.

Although the particular materials chosen by nearly all the physicists who have experimented on dissociation with small vessels or tubes—mostly clay, porcelain or asbestos—have no direct chemical action on the dissociated gases; yet the influence of surfaces in general, and especially of highly heated surfaces, have been entirely overlooked. Heat expands the molecules of gases and thus tends to weaken the chemical affinity of their atoms, until, at a certain high temperature, expansion overpowers chemical attraction and dissociation takes place; but if highly heated surfaces are present which tend to attract or condense one or other of the elements constituting the gas experimented upon, dissociation is facilitated and will necessarily occur at a much lower temperature. Hitherto physicists have been satisfied to prove dissociation by showing that a flame became longer with increase of temperature. It was maintained that, as the temperature of the flame increased, dissociation set in more and more, thus causing an extension of the flame combustion and dissociation being repeated over and over again.

Draughtsmen.

THE condition of trade in England may be inferred from the following extract from an editorial in a paper published in that country:

"There are, we know, an enormous number of draughtsmen out of employment, many of whom offer all sorts of inducements to employers in order to gain a situation; in their advertisements they say 'salary no object,' others offer to give the first month's work without salary, and a few are in a position to offer a bonus to any one who will obtain an appointment for them. When an advertisement appears in this or any other journal for a draughtsman there are scores of replies, and yet out of this large number not a dozen suitable men can be selected for the appointment. Still, it will appear quite incredible to some that there are several engineering firms who find it *impossible to obtain suitable men* to fill their often-recurring vacancies. The number of draughtsmen has largely increased, but the quality of their work has deteriorated, and is not what it used to be. Good men are very scarce, and, as a rule, do not wait long for a post. We have to thank the premium apprentice system for this state of things. Pupils hurry through the shops, and, finding the drawing-office congenial to their taste, decide to remain there, and seeing that three or four years only has been devoted to the acquisition of their trade, we need not be surprised that their services are not in very great demand. We admire the action taken by the two draughtsmen who were tired of being out of work, and we trust that many more who have a poor chance of obtaining situations at the drawing-board may follow their example, and seek to obtain work at the lathe or at the vise; and, providing they are steady and industrious, we are sure they will be far more successful in the shops than they can ever hope to be in the office, leading hands, under-foremen, and working foremen being at all times in great request. And we may add that, having had experience in both the works and the office, we know that in the former place, despite the dirt and roughness of the work, the health and happiness is promoted by the manual labor."

[Complaint has recently been made here of a scarcity of good draftsmen, and probably some of those who are out of employment on the other side could get it if they emigrated to this country.—EDITOR AMERICAN RAILROAD JOURNAL.]

Electrical Appliances for Railways.

THE director of the railway telegraphs of Sweden, Herr Stork, has invented an apparatus worked by electricity, which indicates to an approaching train whether everything is clear for its entering a station, or the reverse. In order to accomplish this, the inventor fastens with screws two little hermetically-sealed boxes of cast-iron to the side of the rails, at a distance of 1,000 to 1,500 yards from the station, the boxes being fixed a few hundred yards apart. Between the latter, by the side of the line, a little tower 10 or 12 feet in height is raised, provided with a disc and dial, which indicates the state of the line, "clear" or "danger," to the driver of the train. At the station is an electric pile or battery, the one pole of which is connected with the earth, the other with an insulated conductor running to the tower. Here, after having been connected with an electro-magnet, it is divided into two parts, each of which is again connected with a box referred to. When the train approaches, the rails, and with them the boxes, are slightly oscillated, and this sets a metal spring in the box in motion, whereby the insulated conductor in it is electrically connected with the earth. The circuit from the electric battery is thereby closed, the electric current is opened, which sets a simple wheel in the signal tower in motion, and this turns the dial on the disc on "clear." This occurs as the engine passes over the first box; when it passes the second one the dial is turned back on "danger," making everything ready for the next train. By the aid of a special wire between the signal tower and a controlling apparatus at the station, indication is given in the latter place whether the signals have been made aright. If the station be not clear to receive the train the current is kept closed in that place, whereby the dial remains pointing to "danger."

This invention has proved so successful and reliable that fifty railway-stations in Sweden are to be provided with it.

Mixed Trains.

MR. CLEMENT E. STRETTON, the consulting engineer of the Amalgamated Society of Railway Servants, in England, in a letter to the *English Mechanic*, says: "I think there can be no difference of opinion as to the necessity for mixed trains being discontinued.

"With regard to the proper position for the passenger carriages to be placed in a train, very important points can be brought forward on either side; but I most certainly agree with the views of the Board of Trade, and the Amalgamated Society of Railway Servants, that the balance of advantage shows in favor of placing the carriages next to the engine and in front of the wagons.

"The carriages can then be fitted with continuous automatic brakes, and with a communication cord. The driver can, without trouble, stop the carriages at the platforms, which is a difficult matter when they are at the rear of a long coal train. Much greater fear is to be apprehended from the breakage of wagon axles, tires, and couplings, or from wagons leaving the line, than from collisions.

"It must also be remembered that the risk of collisions will be very greatly reduced by the use of the continuous brakes, and, further, we must not lose sight of the fact that, when the carriages are at the rear they are quite as liable to be run into by a following train. Quite recently a London & Southwestern mixed train became uncoupled near Crewkerne, and the two portions came into collision. The passenger carriage was at the rear, and six passengers and the guard were injured. That is one instance out of many in which, had the passengers been next the engine, they would have escaped all risk."

Sugar in Cement.

THE letter respecting the use of sugar in cement and mortar, which appeared in the *Times* last week, and which was noticed by us, has given rise to some further correspondence. Surgeon-General W. Robert Cornish has written to say that the Indian practice of mixing "jaggery," or unrefined sugar, with mortar in certain proportions, is very ancient. In the latter part of the last century a wall was erected as a fortification to the settlement of Madras, and remained until it was ordered to be removed in 1859. The task proved exceedingly difficult, and the separation of the bricks from the mortar was impracticable. Afterwards the original specification for the wall came to light, and it was found that it required that the mortar should include a certain proportion of "jaggery," mixed with shell lime and river sand. A copy of the document was published in the *Madras Mail* in 1873. The same writer states that the polished *chunam* walls, for which Madras is famous, are prepared with cement made with unrefined sugar. Another correspondent, Mr. Nathaniel Stevenson, testifies to the beneficial effect of adding an ounce of sugar to each half-pint of water in mixing plaster-of-paris for models. A third writer mentions the use of "goor," a coarse sugar, as an ingredient of mortar in India. Masonry cemented with this material requires to be blasted before it can be destroyed. — *Engineering*.

The Slipping of Locomotive-Wheels.

SOME interesting facts were brought out during a series of tests of a locomotive traction-increasing device on the Boston, Hoosac Tunnel & Western Railway a few months ago, under the supervision of Mr. Charles H. Cory, then general superintendent of the road. The device in question was a peculiarly shaped draw-bar which connected the engine and tender, and which, on up grades, or wherever heavy pulling was required, threw part of the weight of the tender upon the rear end of the locomotive. Two Brooks locomotives were used in the tests, both of them 17 × 24 inches, four-wheel connected. Referring to one of the facts shown by the experiments, Mr. Cory writes: "A pedometer was attached to the driver-axle of one of the locomotives, and, from its records taken before and after the automatic draw-bar was attached, it was found that the driving-wheels revolved faster, or made more turns before the device was put on than afterward. In other words, the wheels made over four miles more on a run of 46 miles without the draw-bar than with it. The experiments were made with as nearly as possible the same tonnage in each trip." Thus it appears that the drivers made fully 50 miles of revolutions to go 46 miles.

[It seems very desirable that some accurate experiments should be made, which would determine this vexed question of the slipping of locomotive-wheels. At present, there is testimony to prove that there is very considerable slip to locomotive driving-wheels while running, whereas other experimenters have not found that there is any. To set the vexed question at rest beyond dispute, some very carefully made experiments would be required, as there are many chances of error which might lead to erroneous deductions. — EDITOR OF THE RAILROAD JOURNAL.]

Has the Engineer Control Over the Wear of Tires?

J. H. SETCHEL, secretary of the Railway Master Mechanics' Association, has sent out the following circular:

To the American Railway Master Mechanics' Association.

GENTLEMEN:—The undersigned desire answers to the following questions:

1st. Has the locomotive engineer any control over the wear of tires?

2d. If so, in what way?

3d. What is your method of determining the wear of tires?

4th. Do you have regular engineers on your locomotives?

5th. Will tires run longer between turning with regular engineer than with different engineers?

6th. Is a free use of sand desirable, or not, as regards the wear of tires? Give figures, if possible; if not, the experience of yourself or engineers.

FRED. B. GRIFFITH.
J. S. GRAHAM,
JOHN MACKENZIE.

All communications should be sent to John Mackenzie, superintendent motive power, New York, Cincinnati & St. Louis Railway, Cleveland, Ohio.

Compound Locomotive.

The (London) *Engineer*, of October 22d, contains engravings of a compound locomotive, on Nisbet's system, for the North British Railway. The engine is of the "American" type, with inside cylinders. The large or low-pressure cylinders are located in the usual position in the lower part of the smoke-box. The small or high-

pressure cylinders are immediately in front under the front foot-plate, and are placed "tandem" fashion, the two pistons being each connected to the same rod. The *Engineer* describes the locomotive as follows:

"The engine was originally built in 1872, and had cylinders 17 inches diameter and 24 inches stroke, the driving-wheels being 6 feet 7 inches diameter, and having a bogie in front, as shown.

"In the arrangement illustrated, the high-pressure cylinders are 13 inches diameter, that of the low-pressure being 20 inches; the stroke remaining at 24 inches. The valve-gear employed is Joy's, arranged in such a way that the high-pressure valves can be worked expansively, independent of the low-pressure valves, and *vice versa*, an arrangement which has shown decided advantages in practice. The steam passes directly from the exhaust of the high-pressure cylinder into the casing of the low-pressure cylinder, there being no intermediate receiver. The engine works with great freedom, and has shown excellent results in speed and power, as well as a marked decrease in its original consumption of fuel."

Signals.

A CORRESPONDENT of the *English Mechanic*, who says he has had nearly six years practical experience in railway signaling, says:

1. That all signals should be placed on the left side of the line to which they refer, where possible, and should have a good sky background where necessary.

2. All home signals should be slotted from the box in advance—*i. e.*, that the home signal at the box in the rear could not be lowered, unless the man in the box in advance, after giving "line clear," moved a lever in his cabin, which would unslot the home signal at the box in the rear.

3. All distant signals from the box in advance should be placed upon the same post as the home signal at the box in the rear, and should be slotted with such home signals.

4. All distant signals should be interlocked by the home signals—*i. e.*, before the distant-signal lever can be pulled over, it would first be necessary to lower the home signal to which such distant signal refers.

5. All distant signals which cannot be seen from the box from which they are worked, should be fitted with repeaters and (for night use only) indicators to show that the light was all right, which, in event of the light going out, would give alarm to the signalman by ringing a bell.

6. All home signals should be worked by rods and not wires, the former being more certain in action and not liable to break or be affected by changes in temperature.

7. With regard to lights, red should indicate "danger," green, "all right;" and for back lights, purple, when the signal is "on," and no light at all when "off."

Water-Testing.

THE following tests for water should be made widely known among those interested in water supply:—For hard or soft water: Dissolve a small quantity of good soap in alcohol. Let a few drops fall into a glass of water. If it turns milky, it is hard; if not, it is soft. For earthy matters or alkali: Take litmus paper dipped in vinegar, and if, on immersion, the paper returns to its true shade, the water does not contain earthy matter or alkali. If a few drops of syrup be added to a water containing an earthy matter, it will turn green. For carbolic acid: Take equal parts of water and clear lime-water. If combined or free carbonic acid is present, a precipitate is seen, to which, if a few drops of muriatic acid be added, an effervescence commences. For magnesia: Boil the water to a twentieth part of its weight, and then drop a few grains of neutral carbonate of ammonia into a glass of it, and a few drops of phosphate of soda. If magnesia be present it will fall to the bottom. For iron: Boil a little nut gall and add to the water. If it turns gray or slate, black iron is present; (2) dissolve a little prussiate of potash, and if iron is present it will turn blue. For lime: Into a glass of the water put two drops of oxalic acid and blow upon it; if it gets milky, lime is present. For acid: Take a piece of litmus paper. If it turns red there must be acid. If it precipitates on adding lime-water, it is carbonic acid. If a blue sugar paper is turned red, it is a mineral acid.

American Locomotives in England.

To a suggestion that one or more American locomotives should be sent to the Newcastle Exhibition, to be held next year, the *Mechanical World* says: "We would remind American builders that if they desire to sell their engine, they must have a care that it does not exceed the requisite width. The passenger engine would be all right, probably, but we much doubt if a consolidation engine could run on many of our roads. In the year 1880, when the first consolidation engines were set at work in New South Wales, it was found necessary to attach a template, representing a transverse section of the engine, through the cylinders to the front of an older engine, and run carefully over the line, with the result that there was much hewing of masonry in station yards, and sawing of timber platforms at many stations before the huge engine would pass clear, the wide spread and great diameter (20 inches) of the outside cylinders bringing up the width of the machine to a dimension unexpected when ordering the engines."

The Effect of the Charleston Earthquake upon Railroads.

MR. EARLE SLOAN, assistant geologist, United States Geological Survey, thinks that the peculiar subsoil of Charleston and the want of lateral resistance, due to enclosing streams, had much to do with the great damage done there, which damage was otherwise out of proportion to the distance of that city from the legitimate line of greatest disturbance. On this line are found numerous expressions of vast energy; as especially noted in the forcing out of line and pushing forward of railway tracks, the dragging and splitting of cross-ties, breaking of angle-plates and shearing of track-bolts. Where short trestles afforded increased resistance, the accumulated rails had been whipped into sharp and manifold curves; and great gaps had been left in the track as a result of this pushing together of the rails. At intervening streams the banks seem to have approached each other, jamming the superstructure and bulging up the stringers.

NOTES AND NEWS.

RAILROAD ACCIDENTS:—It is said that about 80 per cent. of the railroad accidents in Great Britain are due to mistakes made by the signalmen and engine drivers, or to fogs.

THE CHINESE STEAMSHIP *Takataman* burst her boilers while running under high pressure in a gale off Nilgata, Japan, and ninety-six persons perished, including the officers, who were Englishmen.

MIXED TRAINS:—At the Railway Servants' Congress, recently held in Brighton, England, all the speakers on this subject were in favor of placing the passenger-cars next to the engine, as being the safest place in a mixed train.

MASTER MECHANICS' AND MASTER CAR-BUILDERS' CONVENTIONS:—The Master Car-Builders will hold their next convention in Minneapolis, on the second Tuesday in next June. The Master Mechanics will meet a week later in St. Paul.

RAILS:—The Welsh correspondent of *The Engineer* writes: "Whispers of good news reach us. The colonies are wanting rails; New South Wales to wit, with its rails for 400 miles, and more demands are coming in from home railways and collieries."

STEEL RAILS:—It is reported that inquiries for 100,000 tons of steel rails are now in the market. Delivery is not to commence until next June. Fifty thousand tons are required for Victoria, and the remainder for South America, Canada, and the United States.

CONTINUOUS BRAKES:—The following resolution was adopted at the Railway Servants' Congress, held in Brighton, England: "That in order to discover what continuous brakes actually fulfilled the conditions imposed by the Board of Trade, this congress should urge upon the government to appoint a committee of experts to investigate and report upon the question."

The Engineer says that there was certainly remarkable unanimity in favor of the Westinghouse brake at the congress.

MR. THOMAS W. FREDERICK, South American agent of the Westinghouse Air Brake Company, died at Para, Brazil, October 3d, of yellow fever. He was formerly assistant superintendent of the Pardee Car Works, at Watsontown, Pa.; then inspector of West Shore cars at Pullman, Ill. He was also, for a short time, master mechanic of the road at Buffalo, and also assistant engineer.

THE EIGHT HOURS MOVEMENT.—Newcastle-on-Tyne was the place where the nine hours movement in the engineering trades was first established some years ago, and now an agitation in favor of an eight hours league is being vigorously carried on. Both sides of the question are being freely discussed. There are many people who believe that the adoption of the nine hours movement did a great deal of harm to trade.

COPYRIGHTING ENGINEERING DRAWINGS:—The desirability of something being done to protect the drawings and tracings prepared by engineering firms, was discussed at a recent meeting of the Manchester Association of Engineers. It was said that these are often appropriated, without any acknowledgement whatever, after they have been supplied in response to inquiries for estimates and plans for certain specified work. The president urged that it was really requisite that some steps should be taken, with the view, if possible, of obtaining some sort of copyright protection for such drawings.

RESTORING BURNT STEEL:—The following simple—and it is said—efficacious, and well-proved method for restoring burnt cast-steel, so called, to its original good quality and usefulness is given by the German correspondent of *The Engineer*: "It consists in heating, slowly and carefully, to avoid sudden flashing up, of three parts of pure colophony—black resin—and two parts of good boiled linseed oil, stirring quietly all the time of melting, which produces a dark-brown syrupy mass, and then introducing to it the burnt cast-steel whilst red hot. By repeating the operation, the quality of the steel will be improved.

ACCIDENTS:—In a recent discussion before the Manchester Association of Engineers, it was said that there was still much want of knowledge with regard to the proper treatment of metals, and, perhaps, nowhere was there still so much "rule-of-thumb" as in the use of cast-iron in the foundry. When they had guns that broke down; when they heard continually of lost ships and of boilers blowing up, he would ask them to take his view that there was no such thing as an absolute accident; it was a combination of untoward conditions, and if all the circumstances could be clearly traced, it would be found that there had been either ignorance, wilfulness, parsimony, or some inexcusable error of judgment which had led up to the disaster.

OIL TEMPERING:—As to the value of tempering in oil, it is curious how doctors differ. Mr. Adamson, president-elect of the British Iron and Steel Institute, denounces the practice. He admits that a higher tensile strength is obtained, but says that it is at the expense of ductility, and that a number of severe, but unequal, strains are probably set up by it, tending to facilitate or even commence rupture. On the other hand, Mr. Vickers, of Sheffield, who is certainly also a high authority, appears to hold a different opinion. He says that the important feature of oil tempering is not so much that it increases the ultimate tensile strength as that it raises the elastic limit, which is after all the great desideratum.—Correspondence of *The Engineer*.

STEAM ENGINE ECONOMY:—In a recent address, Professor Kennedy stated that it was an undoubted fact that only a comparatively small portion of the heat put into an engine was used, but the statements that were so freely made in prospectuses and other documents, that certain new engines utilized 50 per cent: more heat than any previous inventions, were altogether erroneous. He desired to impress upon the members that perfect accuracy was one of the chief essentials of an efficient engineer. The loss occasioned by the clearance spaces, for instance, might be very much reduced by the use of very proper compression or "cushioning." It was a pity that the clearance spaces of a steam engine were not considered as among its most important dimensions.

THE MECHANICAL THEORY OF HEAT:—In a paper on "The Rise and Progress of the Mechanical Theory of Heat," Mr. Elliott, president of the East of Scotland Engineering Association, traced the history of the theory from the speculations of Locke and Bacon up to the present day. The lecturer concluded by stating, as an illustration of the thorough hold the first law of thermodynamics had taken upon the public mind, to the total exclusion of the second, that nothing is more common than to read that 90 per cent., or thereabouts, of the heat supplied to a steam engine is absolutely wasted, the fact being, when proper account is taken of the second law, that in the best engine something like half this quantity is theoretically unavoidably wasted.

THE EIFFEL TOWER is likely to afford plenty of excitement to Parisians before it is completed. The first step is about to be taken in ascertaining what curve is to be given to the sides. A chain or cord suspended between two points forms a catenary curve corresponding with the weight. Now, it is supposed that something of the kind also occurs when the suspension is vertical. The engineers have, therefore, arranged to cause a balloon to ascend to the height of the proposed tower. From the boat ropes will be hung to the ground and fixed there. From their curvature the contour of the tower will be derived. It is a novel experiment, but as there is some difficulty in arranging the slope of an ordinary lighthouse, we cannot expect that a colossal tower, made of iron plates, is to be designed forthwith without much deliberation.—*The Architect*.

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NEW YORK, DECEMBER, 1886.

Principal Contents of this Number.

MISCELLANEOUS AND SELECTED.

NOTES AND NEWS.

EDITORIALS.

STREET-RAILWAYS.

MANUFACTURES.

NEW INVENTIONS.

VOLUME LX.

OWING to the consolidation of this paper with *Van Nostrand's Engineering Magazine*—the present volume of which ends with December—and in order to begin the combined publication with the calendar year, the LX Volume of the AMERICAN RAILROAD JOURNAL will end with this number.

ANNOUNCEMENT.

THE AMERICAN RAILROAD JOURNAL has been sold to Mr. M. N. FORNEY, who will be its editor and owner from this date. He has also arranged for the purchase of *Van Nostrand's Engineering Magazine* on the completion of its current volume at the end of this year. The two publications will then be consolidated with the title of the AMERICAN ENGINEERING MAGAZINE AND RAILROAD JOURNAL, which will be devoted to the discussion of engineering and mechanical subjects. Railroad construction and operation being, however, the most important branches of engineering in this country, more space will be devoted to them than to any other one department of engineering. Questions of traffic and finance will not be taken up, excepting so far as they are incidentally concerned with engineering matters.

The new publication will have, each month, about double the amount of reading matter heretofore contained in the RAILROAD JOURNAL—the subscription price, $3.00 per year, will remain the same as heretofore.

The office of publication will hereafter be at No. 23 Murray street, New York.

WARMING AND VENTILATING CARS.

THE fact that such a diversity of systems for warming cars is in use, indicates that none of them are satisfactory. It is the effort to get some means of heating cars, which will have the least objections, that leads one person to adopt steam, another hot water, and a third warmed air, while a large number adhere to the use of ordinary stoves as the simplest and most practicable way to warm cars under ordinary conditions. Opinions, with reference to which of these is least objectionable, vary as the practice does. If what may be called the algebraic sum of the advantages and disadvantages of any system, showed that it had a marked superiority over all others, the result would be that such a system would be adopted and the others would fall into disuse. When we come to inquire what the conditions are which a car-heater should fulfill, we find that they are the following, stated in the order of their importance:

1. It must heat the car comfortably in the coldest as well as in comparatively mild weather.

2. There should be the minimum amount of danger of setting fire to the cars in case of accident.

3. Some system of ventilation should be provided which can be used in connection with the heater, and which will furnish a reasonable supply of fresh air at all times without discomfort to the occupants of the car.

The first condition is the easiest of all to fulfill. Wood or coal-burning stoves of the simplest description will warm a car sufficiently for comfort, even in the coldest

weather. It is true that the heat from such stoves will not be evenly distributed, and the car is apt to be heated upside down, that is, the upper air will be very warm when it ought to be cool, and that nearest the floor will be cold when it ought to be warm; but there is usually no difficulty with simple forms of stoves to get heat enough at all times. It is only when complicated stoves are used that there is trouble in getting sufficient heat. These get out of order, or the attendants do not understand how they should be managed, and the fire in them consequently refuses to do its duty. The difficulty with ordinary stoves is the great danger that they will set fire to the cars in case of accident. The horrible occurrences of this kind, which happen nearly every year, are sufficient reasons for doing all that can be done to prevent them.

Three methods have been proposed and are in use for lessening this danger—one is to make the stoves of wrought-iron so that they would not be easily broken or crushed. Another is to place the stove below or outside of the car, and the third is to heat cars with steam taken from the engine, or from a boiler in the baggage car. The latter plans have so far been open to the serious objection of being liable to get out of order, and, consequently, cars are thus left without any heat at all, and, in accordance with a law of the perversity of inanimate things, this is most certain to occur in the coldest weather when heat is most needed.

The plan of placing the heaters below the car has been in use on the Philadelphia & Reading Railroad for a long time, and has been very successful there; but this method has not been adopted on other roads, and, therefore, it has evidently not commended itself to the managers of other lines. There are, however, very great advantages in having heaters below or outside of the cars. A stove or other heater is always an uncomfortable object to persons who are near to it. It takes room which could be occupied by passengers if it were not there, and dust and ashes are inevitable concomitants wherever a stove is located. The advantage of keeping them outside instead of inside of cars is obvious.

Ventilation, like heating, is easily effected. All that is required is simply to provide openings enough for the admission and escape of air. But when the air outside it cold, its admission, unless it is warmed at once, becomes a source of discomfort to passengers. No reference, excepting this, need be made to the common delusion that a car, or other apartment, can be ventilated by providing openings for the escape of air, without admitting any. If the atmosphere in any apartment occupied by a number of people is to be kept pure, an adequate and constant supply of fresh air must be admitted.

Three methods have been employed for admitting a supply of fresh air into cars, so as not to be a source of discomfort to passengers. One is to allow it to come in near to the stove, so as to mingle with the hot air around or above it. The next is to divide the current up into many small streams and distribute them through the car so that none of them will be perceptible, and the third is to warm the air before it enters the car. The latter has the very great advantage that it is impossible to warm the car without at the same time ventilating it. If these two conditions are not inseparable, the consequence is that average or inferior human nature, having an abhorrence of fresh air, will heat the apartment and exclude the requisite supply of oxygen. It would seem then, that if a system could be devised which would permit the stove or heater to be placed below the car, and it was arranged to furnish a supply of warmed air, that the required conditions of immunity from danger, and perfect ventilation would be fully met.

It should be observed here that stoves and furnaces may be divided into two classes—one, the vertical type, like an ordinary coal-stove or a blast-furnace, which approximates to a cylindrical form set upright; the other is the horizontal type like an old-fashioned wood stove or the grate of a steam boiler. In the attempts to put stoves or heaters below cars, the blast-furnace type has usually been adopted. While this affords facilities for feeding the fire from the top, or from the inside of the car, the grate, ash-pan and dampers are comparatively inaccessible. If a horizontal type of heater were adopted, the fire could be fed from the top or the inside of the car as easily as it could be with a vertical stove, and it would have the advantage that the condition of the fire could be seen much better from above than is possible with a vertical heater. A shaking grate, similar to those used in locomotives, could be adapted to such a stove, and, by having openings in the floor of the car, the fire could be attended to from the inside. A suitable air space should be provided around the heater and cold air admitted to it, and then conducted into the car. One difficulty in scuh an arrangement is to find room for the smoke-flue. This may be carried along horizontally under the car and then through the saloon. By placing the heater as near to one of the trucks as possible, the horizontal length of the flue could be reduced to a minimum, and would be no more objectionable than the horizontal part of an ordinary stove-pipe.

Such an arrangement would have the important advantages of immunity from danger in case of accident; it would give thorough ventilation, and would occupy no room in the inside of the car. At the same time, the dirt and ashes would all be kept outside, while the fire could be managed from the inside.

LIFE AND PROFITS OF A CAR.

A PAPER, by Mr. E. C. SPALDING, with the above title, which was read at the Car Accountants' Convention, at Buffalo, was published in the September number of this JOURNAL. The gist of the paper is contained in the following table and extracts, which are reprinted from it. The figures give the average cost of repairs made on cars of various ages for one year, and also the average mileage, money earned, and the profits and loss on cars of the Western Atlantic Railroad.

EARNINGS OF BOX-CARS IN GENERAL SERVICE.

Mileage.	Money.	Repairs.	Net Profit.	Per cent. Profit.	Net Loss.	Per ct. Loss.	Age of car. Years.
13,149	$98.62	$9.58	$89.04	18			1
13,478	101.08	38.13	62.95	12¼			2
10,475	78.56	48.24	30.32	6			3
9,847	73.85	45.85	28.00	6			4
9,881	74.11	57.31	16.80	3			5
9,349	70.12	70.74			$0.62	1-9	6
8,968	67.26	60.74	6.52	1¾			7
9,250	69.37	55.49	13.88	2 4-5			8
9,295	69.71	49.80	19.91	4			9
7,656	57.42	53.67	3.75	¾			10
101,348	$760.10	$489.55	$271.17				

"It will be noticed that, for the first five years cars make good mileage, and will average 9 per cent. profit on the investment; but, during the next five years the mileage decreases, repairs increase, and the net profit is reduced to an average of one and three-fifths per cent."

The author of the paper drew the conclusion that "these figures prove that mileage at the rate of three-fourth cent per mile is not excessive, and results only in a fair profit on the investment."

In the October number of the JOURNAL, these conclusions were questioned and the statement was made that "the earnings of the car should not only pay interest on its cost, but should also pay *for the difference in value between its cost when new and that of the old material when destroyed.*"

The following table was then given to show the results, if provision was made for the renewal of the car when worn out:

	Cost of Car $500.00	Net Profit.
First year, Interest on Cost of Car.....	$25.00	$89.04
Second " " " "	25.00	62.95
Third " " " "	25.00	30.32
Fourth " " " "	25.00	28.00
Fifth " " " "	25.00	16.80
Sixth " " " "	25.00	
Seventh" " " "	25 00	6.52
Eighth " " " "	25.00	13.88
Ninth " " " "	25.00	19.91
Tenth " " " "	25.00	3.75
	$750.00	$271.17
Value of old material in car		150.00
	$750.00	$421.17
Loss on car service at end of tenth year.....		328.83
	$750.00	$750.00

To this the *Railroad Gazette*, of October 22d, says:

"The error lies in assuming that the cost of 'repairs' which the mileage rate of three-fourth cent per mile is found to cover with an average surplus of $271.17 at the end of ten years' time, includes only repairs proper, but not renewals. * * * *

"To make a fair statement, based on Mr. SPALDING'S figures, of the profit and loss on an average car kept in service at three-fourth cent per mile for ten years, it should be thus:

Interest on cost of car ($500) at 5 per cent. for ten years.....	$250.00
Repairs (which include renewals), actual average.....	489.55
Total debit charges.....	$739.55
Cr. By 101,348 miles run at ¾ cent per mile.....	761.11
Net profit on ¾ cent rate.....	$21.56

"The JOURNAL increases the debit charges by $500 for the first cost of the car, and the credit charges by $150 for the value of the old material in the car when broken up—neither of which charges have any pertinency in this connection, and thus reaches what it justly regards as the 'very important' result, that railroad companies are losing $328.83 (being $350 less 21.55 above, plus a decimal error) instead of making $21.55 on every $761 of car mileage earned, as they actually do.

"The bare fact that such large-sized figures indicate that the railroad public has been guilty of the fatuous folly of fixing but little more than half of a fair mileage rate for cars should alone excite suspicion. Such an 'impeachment of a whole people' will rarely, on investigation, be found to be well founded. When we remember the way in which the present mileage rate was reached—by beginning at 3 cents per mile, and gradually dropping it through 2 cents, 1½ cents, 1 cent to ¾ cent, the improbability of its having been dropped so very much too far is increased."

It will be noticed that the above assertions are not supported by either evidence or argument. They are based upon an assumption of superior knowledge of the whole subject, which makes evidence and argument unnecessary.

Mr. SPALDING, in his paper, came to the conlusion that at the end of ten years it does not pay to run freight cars because the cost of repairs is then nearly equal to their earnings. If that is true, all that can be done on the expiration of the ten years is to break up the cars and build new ones in place of them. There must, therefore, then be an expenditure equal to the cost of a new car for "renewal." This cost has been assumed to be $500, and this amount, we are told, is included in $489.55, which is the total average cost of repairs per car for the years. How the lesser sum can include the greater is not clear. There is the loop-hole, though, that the old material of a worn-out car is worth $150, so that the actual net cost for "renewal" would be only $350. But, if $489.55 includes $350 for the renewal of the car, it will leave only $139.55 for keeping it in running order during the whole of the ten years of its life, or at the rate of $13.95½ per year. Now, can this be done? Let us take the figures of the Lake Shore & Michigan Southern Railroad. The following table gives the number of freight-cars in service on that road for the six years beginning with 1880, the number of new cars built each year, the cost of freight-car repairs, and the value of the new cars built, estimated at $500 each. The cost of the new cars is then deducted from the cost of repairs, which gives the cost of keeping the old cars running without renewals. This amount divided by the number of cars owned, less the new cars built, gives the average cost of running repairs per year.

	1880.	1881.	1882.	1883.	1884.	1885.
No. freight-cars in service.....	12,107	14,663	16,796	16,649	16,355	16,629
No. new freight-cars built.....	107	66	58	197	108	38
Cost of freight-car repairs	$627,187	$677,468	$680,080	$602,594	$399,185	$604,495
Value of new cars...	53,500	33,000	29,000	98,500	54,000	19,000
Amount of running repairs	573,687	634,468	651,080	504,094	345,185	586,495
Running repairs, per car.....	47.80	43.46	38.90	30.64	21.24	35.3

It will be seen that the cost for the six years averages $36.23 per car per year. If then the Western & Atlantic Railroad Company can maintain cars at an annual cost of $13.95½ each, they have done it at *a little over a third* of the cost on the Lake Shore Railroad.

To an inquiry "whether in his paper on 'Life and Profits of a Car' the cost of repairs includes renewals or simply such repairs as are necessary to keep cars in service," Mr. SPALDING replied, "The repairs represent all repairs made on car from time it leaves shops a new car until it returns to be torn down." He says not a word about renewals.

THE many friends of LEANDER GAREY, who was for a long time superintendent of the car department of the New York Central Railroad, and president of the Master Car-Builders' Association, will be pained to hear of his death from typhoid fever, on Wednesday, November 24th. The sad news came too late to permit more than this brief notice of it in this number of the RAILROAD JOURNAL. A more extended notice of his life will be given hereafter.

Street-Railways.

PROGRESS OF ELECTRIC MOTORS.*

AFTER a review of the history of electric motors, the report gave an account of the electric railroad in Baltimore, as follows:

Passing over some minor achievements, I am led to speak of the installation of the Baltimore & Hampden Electric Railroad as the one commercial plant which has been operated for a sufficient time to allow of a proper statistical comparison not only with horses, but with other mechanical tractors, and in so doing I append figures showing results of operating this road for twelve months by the Daft system, including a winter of extraordinary severity for that region, and under such conditions as, I am sure you will conceive, are sufficiently commercial in their character. A profile of the gradients and curves on this road, will be a sufficient assurance that the experimental element has not been allowed to predominate in selecting the ground for such purpose, except in a manner sufficiently prejudicial to afford unusually severe means for satisfying ourselves as to its enduring character.

The statistics here appended will afford so clear an insight into the result of this experience, that I will not further dwell upon it except to remark that, though I must confess myself strongly in favor of so convenient and sufficient a substitute for horses, or other mechanical tractor so far tested, I have not allowed myself to be led astray by the scientific allurements of the case, and feel satisfied that a careful analysis of the case will lead others to conclude as I do, that electricity, employed as the means of transferring the energy of mechanical tractors, is not only coming, but is here; and in all essential particulars has been here for sometime past. It is not too much to add that the Baltimore & Hampden road stands alone in this particular, that it was started on a purely commercial basis as a purely commercial transaction, and has continued, and is now being extended simply because it has proved its right to stay, by the performance, which leaves little to be desired in that direction.

About the time that the Baltimore road was started, the Daft Company were engaged upon the manufacture of a large electric motor, "Ben Franklin," intended for use for experiment on the Ninth Avenue Elevated Railroad, in New York. This was subsequently put in operation and experimentally used for a considerable time on a short track at Fourteenth street, and also towed four cars over two miles of that road. It was ascertained during these experiments that a more powerful motor would be required to fully meet the requirements of the case, and the experiments will shortly be resumed on a larger basis.

Lieut. F. J. Sprague has since built and put in operation a motive car on a short branch of the Third Avenue Elevated Railroad at Thirty-fourth street. The experiments with this motor have not yet been concluded, but I understand that they have been quite successful, and will probably result in an extended application of this motor.

In concluding this brief review of this comprehensive subject, I feel that I should not be doing it full justice if I were not to attempt a refutation of many charges which have been brought against electricity by persons unfamiliar with its peculiarity.

It is said to be unsafe, and though with high potential, this is undoubtedly the case, I am prepared to say that, with the potential now in use on the Baltimore & Hampden Railway, the experience, by a year's constant running, eighteen hours per diem, leads me to state that, so far as human life is concerned, it is absolutely harmless.

Secondly, it has been said to be uncertain. Again, quoting the experience of a year, I am able to state that after the little difficulties incidental to a primary installation had been removed during the first month or two, it is as certain as any other form of mechanical tractor in all weather. Third, it has been stated that specially skilled help would be required to operate a line so equipped. I am again able to say that the experience before referred to has enabled me to place upon the road men who were entirely unfamiliar with electricity in any of its applications, and that these men are now our sole reliance for all the operations required, and interruptions are as much the exception with us now, as with any ordinary road.

For the year ending September 1st, 1885, the road carried with three cars, with horses, 227,155 passengers, at 5 cents each, making $11,357.75.

For the year ending September 1st, 1886, the road carried with two cars, propelled by the Daft electric motor, 311,141 passengers, at 5 cents each, making $15.557.05.

An increase of 83,986 passengers, with two cars propelled by electricity, as against three cars propelled by horse-power for the same corresponding time, and an increase of $4,199.30.

The average number of passengers carried per car per annum, propelled by electric power, was 155.570.

The average carried per car per annum for corresponding time by horse-power was 75,718 passengers, an excess of passengers per car per annum in favor of electric power of 79,852.

The average gross earnings per car per annum, with cars propelled by electric power, was $7,778.52; the average gross earnings per car per annum, by horse power, was $3,785.91, showing an excess of gross earnings per car per annum in favor of electric power of $3,892.61.

The average cost of horse power per car per day is estimated at $6.50; the average cost of electric power per day on this road, is one and a half tons of coal at $3.50, equals $5.25.

Engineer, $2.00; fireman, $1.50; oil and waste, .50; interest on plant and repairs, $2.75; making $12.00 per day. The power furnished at this cost is ample to run three motors and cars on this road, making electric power per car per day $4.00. Under more favorable conditions, such as cheaper fuel, or water-power to drive the dynamos, and more favorable gradients and curves, the cost of electric power per car per day would be proportionately reduced.

Respectfully subscribed by

T. C. ROBBINS,
Chairman Committee.

* Part of report by T. C. Robbins, read at the recent convention of the American Street-Railway Association, at Cincinnati.

PROGRESS OF CABLE MOTIVE-POWER.*

AFTER describing the progress made in the construction of cable lines in San Francisco, Los Angeles (Cal.), St. Louis, Cincinnati, Chicago, New York, Philadelphia, Omaha, and Melbourne (Australia), the report gives the following interesting account of the work done in Kansas City:

The Kansas City Cable Railway Company, last July, completed one mile of double-track, as an extension to their present line. It is constructed on the same plan as that already operated. They are now constructing two branches, one of which, it is expected, will be completed next month. This last branch is somewhat different in construction from the main line, it being almost a copy of the Market street line in San Francisco, except the yokes are of cast-iron, and concrete piers are dispensed with. These yokes weigh about 375 pounds each, and are laid four feet apart on a concrete foundation. The conduit is formed of concrete. The track rail is bolted direct to the yoke; no stringers or chairs being used. Stone paving is placed between the slot and track rail, as experience has taught that when paved with wood (which was done on the main line) it is impossible to keep the slot to standard gauge, viz., ¾ inch, it sometimes expanding to 1¼ inch, and again closing to ¼ inch, under atmospheric influences. The carrying sheaves are twelve inches in diameter, placed thirty feet apart. It is intended to operate this branch three-fourths of a mile in length by running main cable around two drums, making it form the figure 8, thereby transmitting power to the branch cable. Another branch two miles long is in course of construction, which, it is expected, will be completed next summer.

This company is at present operating three miles of double-track with one cable, 1¼ inch in diameter.

The following is an extract of test of engines and boilers, made in July last.

Engine cylinder, 24×48 inches; coal used, nut; duration of trial, 17 hours; coal consumed, 14,000 pounds; coal per H. per hour, 51 pounds; water evaporated per pound of coal, 7.37 pounds; horse-power of engine, 159.7; power for cable engine and machinery, 119.06; power for cars and passengers, 40.64; number of trains running, 14; passengers carried, 15,000.

The Grand Avenue Cable Company, of Kansas City, will change their horse line to cable, and are constructing 2½ miles additional.

The yokes are of cast-iron, each weighing about 385 lbs., laid four feet apart on a concrete foundation. The slot rail is a special form of angle steel, leaving a friction surface of 1½ inch for grip shank. It weighs about 38 pounds to the yard, and is bolted to yoke with countersunk bolts, pieces of sheet-iron being placed between slot rail and yoke to permit of adjustment. The track rail is center-bearing and rests on small steel chairs, which are bolted to the yokes. The conduit is formed of concrete; connections from conduit to main sewer are made in such places as are necessary to carry off water. It is thought that portion of this road will be completed next spring, the balance next fall.

The Metropolitan Street-Railway Company, of Kansas City, have obtained franchises to convert three of their horse lines into cable, and work is progressing rapidly on the most important one, viz., the Fifth and Wyandotte line; at present it is a double-track, narrow-gauge line. The cable is being placed on the same route and changed to broad gauge. The horse line is operated while the work of construction is going on by laying temporary side tracks.

The yokes are of cast-iron, with four feet two inches base, each weighing 340 pounds, laid four feet apart on a foundation of concrete. The slot rail is Z-shaped, fastened to the yokes by bolts and ¾-inch brace rods. The top of the slot rail is slightly inclined from the outer edge to prevent horses' shoes and buggy wheels from entering the slot. The conduit is of concrete six inches thick where background is solid, elsewhere twelve inches thick, made from English Portland cement. The carrying sheaves are of cast-iron, chilled, twelve inches in diameter, laid thirty feet apart. At crowns of hills, the diameter of the carrying sheaves is increased to 30 inches, to provide for angle and heavy strain of the cable at those points. Special sewers are made to drain the pits containing these large sheaves. Drain pits are also made at the foot of all inclines into which water from the conduit flows, these pits in turn being connected with the main sewer by twelve-inch pipes. The following figures will give some idea of the amount of work done and material used in the construction of this line:

No. of yards of earth excavated per mile of single track	4,055
" " " " concrete, per single track	3,000
" " " " paving (stone)	3,130
" " " " sand	2,050
" " " " gravel	175
No. of tons of yokes	225
" " " " track rail	98
" " " " slot rail	98
No. of brace rods for slot rail, ¾" x 2' 5", 2,640	10,890 lbs.
" " slot rail bolts for fastening slot rail to yokes, 2¾" x ⅝", 5,280	508 lbs.
" " bolts for fastening slot rail splices, 1⅛" x 5-6", 704	264 lbs.
" " " " " " track rail to yokes, 2¾" x ¾", 7,920	6,336 lbs.
Carrying sheaves and frames	4 tons.
Curve pulleys and frames, each	175 lbs.

It is estimated that this road will cost $50,000 per mile of single track. The power house will contain two engines, 400-horse power each.

Engines, heater pipe, fittings, etc., contracted at	$25,000
Machinery	18,000
Boilers	13,000
Building estimated at	15,000

Cable roads were very successfully operated last winter, snow being combated in such a manner as not to impede the running of cars to any extent. In Kansas City, where grades are almost continuous, snow is swept away with ease. The cab cable line there had a snow plow and sweeper constructed to carry a grip between the axles, and one trip, at full speed of the cable, was generally sufficient to clear the track of snow, and in no instance was the plow ever stalled. When the thermometer fell several degrees below zero, it was not necessary to keep the cable running all night, but the tension carriage was loosened, and sufficient slack allowed for contraction of the cable.

In the discussion which followed the reading of the report, Mr. C. B. Holmes, of the Chicago Cable Railway, being called upon, made some very forcible remarks in favor of the cable system; citing the fact that in the five years of their experience of the cable road, their traffic

* Abstract of Report by Edward J. Lawlers, read at the convention of the American Street-Railway Association at Cincinnati.

had increased seventeen millions of passengers per year. Said that the cable system afforded the best possible means of dealing with snow, that they had had no trouble from that source, and had run the road frequently when it would have been impossible to do so with horses. He said that it would now be impossible to handle their traffic with horses, to the satisfaction of the public, and he had no doubt that had not the cable been introduced, an elevated road would have been completed before this time. They now run their cars nine and a half to ten and a half miles per hour, and that there was no increase of accidents over the time when slower speed was run. They had twenty miles of cable road, accommodating the heaviest traffic, and sixty-seven miles of horse-railroad, and three-fourths of their accidents occur on the horse-railroad. Said that safeguards could be used on the cable road which were not applicable to horse-cars. He substantiated the committee's report relative to the increase of the value of real estate resulting from the cable road. Said that property in Chicago had increased from fifty to one hundred per cent. as the result of its system. They are now adding six miles of single track, and the cable system is thoroughly satisfactory in Chicago. It would be impossible to do the work with horses. The first cost of the road was indeed large, but the diminished expenses for running would amply repay the interest on the investment. Stated that the expense per car mile by the cable system was ten to eleven cents; while with horses it was twenty to twenty-five. He gave as the life of a cable of any merit not less than sixty thousand miles. Said that he had no doubt the new lines adopting the cable would introduce many improvements, and he believed the cable system to be far ahead of any other motor now in sight.

Mr. Wharton, in response to a question as to the waste power in driving the machinery with the cable system, elicited from Mr. Holmes, of Chicago, the fact that 355-horse power were used in driving their twenty miles of cable and its machinery; and that 700 to 750-horse power were required to run 300 cars, that is, one-horse power per car was required. Gave as the cost of furnishing steam for the entire plant, from twenty-five to thirty dollars per day, the cheapest screenings of coal and the sweepings of barns being used for fuel. The length of their cars is twenty-one feet, and their weight about seven hundred pounds.

VENTILATION, LIGHTING AND CARE OF CARS.*

In all the attempts heretofore made to afford ventilation for street-cars, but half the subject has been treated; the aim seems to have been only to provide means for the escape of impure air; while the equally essential means of supplying fresh air has been overlooked. But little air can escape from a car, without a corresponding amount being admitted, hence any system of ventilation that provides only for the escape of air, is impracticable.

Under ordinary circumstances, when the weather will not permit the doors and windows to be kept open, the frequent opening of the door to allow passengers to enter and leave the car, will admit sufficient fresh air to revive that which has become heated and foul through repeated breathing of the passengers, and the cool fresh air coming in will force the warmer air out through the roof ventilators, carrying with it the offensive odors and impurities. Thus we have a simple and effectual system of ventilators for ordinary every-day wants.

But we cannot stop here; the demand of the public now is for cars to be heated during the cold weather. Therefore, the question of ventilation becomes complicated when we introduce heaters into our cars. In a heated car, when well filled with passengers, the air soon becomes unpleasant, and when you enter a car thus heated, you at once feel the discomfort of the foul air; hence our attention should be directed to devising a system of ventilation that is practicable for a heated street-car.

In looking the ground over carefully, we recognize at once that no fixed system will meet the requirements of ventilating a heated car; the condition of the atmosphere being variable, so must any system of ventilation be variable to meet the arbitrary one. For example, to-day may be clear and cold, and if our car be heated to a temperature that is comfortable to the passengers, and our system of ventilation, which we assume to be fixed, so nicely adjusted as to carry off the surplus heated air, which is in turn replaced by fresh air coming in as the door is opened to allow passengers egress and ingress, what will be the effect on those days when we have a cold rain? The passengers will require warmth and also a free circulation of air. Of course, this changed condition can be met partially by graduating the heat, and opening the ventilators.

This example is offered as an illustration to show that any system of ventilation, to be effective, must be variable, so as to permit a large or small amount of circulation, as the condition of the weather and temperature of the air in the car may require.

Your committee has given the subject of ventilation for street-cars considerable thought, but we cannot recommend any system that has come under our notice, as being an improvement upon the old system of side and end roof ventilation.

In the discussion which followed the reading of the report, the general opinion seemed to be that it was profitable, in many cases, to warm street-cars.

* Abstract of Report by Walter A. Jones, read before the American Street-Railway Association at the last convention held in Cincinnati.

The Strength of our Elevated Railways.

Manager Hain, of the New York Elevated Railway system, writes to the *Sun* that the patrons of these roads need have no fear that increased traffic will in anyway lessen the stability of the structure. He states the case as follows:

There are thirty-two miles of double-track road in the system, divided into independent spans of 40 feet each, supported by transverse girders resting on wrought-iron columns. The material used has a tensile strength of not less than 50,000 pounds per square inch, and the Rapid Transit Act limits the strains on the compression and tension members to 9,000 pounds per square inch, the shearing strain on rivets to 7,000 pounds, and the maximum deflection of a girder under load to be not greater than 1–1500 of its length; the factor of safety of the columns

to be five, and the load upon the foundations not to exceed 2,000 pounds to the square foot.

Mr. Hain says that with the increased weight of the engines now in use, necessary to draw five loaded cars, in no case is any portion of the strain anyway near the limits above referred to. He quotes from Fairbairn to the effect that a light plate girder of 20 feet span, subjected to 100 daily deflections equal to one-quarter of its breaking load, will last 300 years, and that with the safety factors used on the elevated structures, there is no possible danger from vibration.

He further states that the pin-connected Sixth avenue structure has been reënforced within the last four years to fit it for the type of engine used; that the Third avenue line is undergoing the same additions, and that the Second avenue line was originally designed for much heavier engines than any now in use.

In March, 1885, the roads were thoroughly examined by a board of expert engineers and bridge builders, and were reported as in better condition than when the structure was first opened for business. Prof. Thurston, then of the Stevens Institute, made tests of the iron and reported no signs of crystalization, and expressed surprise at the good quality of the iron submitted to him.

A large force of men are employed day and night in inspecting the track and structure, and the fifty and sixty-pound steel rail is now being replaced by a steel rail weighing seventy pounds per yard.

New Soda-Motor.

In a recently patented soda-motor, intended for use on street-railways, the process of generating steam is as follows: The caustic soda, which is contained in a reservoir surrounding the steam-boiler, is raised to a high initial temperature by means of jets of burning gas or petroleum, thus evaporating all moisture from the soda. The heat from the soda produces steam in the boiler, which is applied to an ordinary engine; the exhaust steam from the engine is then absorbed by the soda, producing heat sufficient to generate steam, until the soda is supercharged with moisture, when the jets of flame, which in the meantime have been dispensed with, are again ignited to regenerate and reheat the soda. The operation may be repeated continuously. This is a modification of the soda-motors which have been in use several years past in this country and in Europe.—*Science.*

Mexican Railroad Notes.

The following notes are from the *Mexican Financier*, of October 16th:

The street-railroads of Puebla, which have proven a profitable investment, are wholly under the control of the owner, Mr. Leonardo Fortuño, residing at this capital. There are no stockholders or bonds of any sort. The representative of the owner at Puebla, and the active manager of the railways, is Mr. Mariano Fortuño, a gentleman of business ability, who has been very successful in the management of the enterprise. The present extension of the lines at Puebla is about 10 kilometres, but, the coming week, work will be begun on new lines which will add greatly to the value of the system as originally planned by Mr. Fortuño. The material for the lines comes from England and the United States, the steel rails from the former country and the rolling-stock from the latter. A striking feature of the property is the depot, which embraces car-houses and stables, the whole built in the most substantial, and, indeed, elegant manner, forming an embellishment to the city. A personal examination of the rolling-stock showed us that it was first-class in every respect, and the care taken of the animals employed for traction was commendable. The lines are in perfect order. The rates for tickets are six cents for first-class and three for second. This wholly Mexican enterprise is but another illustration of the ample field which exists here for the profitable employment of native capital.

The Attempt to Run Elevated Locomotives by Oil Instead of Coal not a Success.

The experiment on the Third Avenue Elevated road, in this city, to demonstrate the practicability of running a locomotive by crude petroleum, was not altogether successful. Steam was first got up by injecting steam into the boiler of water from another engine. A burner, about five inches in diameter, constructed with a double chamber, one chamber containing steam, the other steam and oil mixed, was situated above the grate-bars of the locomotive. The tender carried barrels of oil, and a tube conveyed the oil to the burner. From one of the chambers of the burner, the oil ran through five small apertures of about an eighth of an inch. In the center of these apertures, was a connection from the steam-chamber of the burner, which terminated in five small teats with apertures of a sixteenth of an inch. Through these apertures, the steam and oil were diffused in spray toward the crown-sheet and tubes of the boiler, and instantly converted into flame. The failure of the experiment was principally caused by sufficient spray not being admitted into the boiler, consequently the combustion was imperfect. The patentees of the system say they can produce a more intense heat in the boiler by mixing the hydrogen and the oxygen so as to form a perfect combustion. By using oil instead of coal as fuel, it is claimed that a train can be run from Harlem to the Battery at a cost of fifty cents.—*Engineering and Mining Journal.*

The Electric Lighting of Trains.

A successful experiment has just been made by directors of the Glasgow Underground Railway in lighting the carriages of the company with electricity. The light is better than gas, while the cost is only about one-third thereof. There are in each compartment two incandescent sixteen candle-power lamps. By the application of a contact maker, only one is lit at a time, and in the event of its breaking the other instantly lights up.—*London Exchange.*

Messrs. Riehlé Bros., of Philadelphia, have issued a new edition of their catalogue of testing machines. In it a great variety of such machines are illustrated and explained, and it indicates the extent to which such machines are now used in the arts.

STREET-RAILWAY NEWS.

ALABAMA.

The Capital City Street-Railway Company, of Montgomery, has increased its capital stock from $50,000 to $75,000. An extension, 3 miles long, will be built and six new cars for the Van De Poele electric system have been ordered.

A street-railroad is to be built between Sheffield and Tuscumbia; over $30,000 has been subscribed.

CALIFORNIA.

At San Francisco, the Automatic Connection Compressed-Air Car Motor Company, capital $1,000,000, has been incorporated by Z. McKinne, S. C. Pressley, and others.

CONNECTICUT.

The proposed horse-railroad between New Britain and Kensington is being worked up. J. A. Trant, L. F. Judd and others have taken stock.

DELAWARE.

At Wilmington, a street-railroad is proposed to run from the Ninth Ward to Brandywine village. If the Wilmington City Railway Company will not build the line, the property owners will do it themselves. It will run to Riverview Cemetery. Mr. R. Townsend is interested.

FLORIDA.

At Fort Meade, a street-railroad company has been incorporated by J. G. Carter, J. A. Edwards and C. C. Wilson. Work is to be commenced very soon.

GEORGIA.

At Athens, J. H. Dorsey is extending the street-railway half a mile to the fair grounds, making the line three miles long.

The Atlanta & Edgewood Street-Railway Company is to be incorporated.

ILLINOIS.

The Freeport Street-Railway Company has been incorporated by George D. Clinger and others; capital, $45,000.

The Bidwell Electric Railway & Manufacturing Company has been incorporated at Chicago by Charles F. Bidwell, Charles S. Jones and M. Bangs; capital, $1,000,000.

The Chicago City Railway Company has been granted an ordinance in Hyde Park to build a cable road on Fifty-fifth and Sixty-seventh streets, and Cottage Grove and Lake avenues; the cost will be about $1,000,000, and the work will occupy a year.

The Chicago West Division Elevated Railway Company, capital stock $10,000,000, has been incorporated by Anson A. Lawrence, Edward T. Cahill and George A. Dupuy, to build a line from between Lake Michigan and the south branch of the Chicago river, to the western line of Cook county, with two forking lines thence to Humbolt Park, the stock-yards and Douglas Park, and to the junction of Western and Blue Island avenues.

A company of New York and Philadelphia capitalists, with from $5,000,000 to $15,000,000 at their disposal, will build an elevated railway from Twenty-second street, Chicago, to Kensington, Hyde Park. There will be about twenty miles of line. The right-of-way has been obtained through the alleys, property owners being paid $100 for the use of the alley at the rear of each lot. The route through Hyde Park has not been decided on, but it is expected to be on State and Adams or Jackson streets. It will be laid out in a zigzag manner to accommodate as many people as possible at Kensington. Colonel G. Howard Ellers, Dearborn street, is consulting engineer and manager for the company.

INDIANA.

At Fort Wayne, the Riverside Street-Railway Company has been incorporated to operate electric street-railways.

KANSAS.

The Genda Springs Street-Railway Company has been incorporated at Genda Springs by Joseph N. Young, and others. Capital, $100,000.

The Hutchinson Street-Railway Company has been incorporated at Hutchinson by A. L. Forsha and others. Capital, $50,000.

LOUISIANA.

At New Orleans, no bids were received in response to the advertised sale of the franchise of the New Orleans Railway. The following is the appraisal:

28,005 feet of track on cobble-stone streets, 3,515 feet of track on square-block streets, 16,944 feet of track on dirt streets, wood tramway, 1,020 feet of track in station and car-house, turn-tables, switches and iron bridge tops	$106,258 00
32 cars at	15,200 00
66 horses at $40 and upward	5,610 00
76 mules at $50 and upward	10,640 00
One square ground bounded by Laharpe, White, Lapeyrouse, and Gentilly streets, with stables, station shops, and other improvements at	26,000 00
Two lots of ground corner of White and Laharpe	2,500 00
Office furniture and safes	454 00
Three clocks—starter's, stable's and watchman's	170 00
Total	$164,582 50

The assessment of the company for 1886 is $61,500, while the assessment against the stockholders is $75,550.

At Brunswick, a company has been organized to acquire and renew an old charter for a street-railroad; the matter has been presented to the Council.

MAINE.

The Portland Horse-Railway Company proposes to extend its tracks from the Congress street terminus to the Spring street terminus, thus forming a belt line.

MASSACHUSETTS.

A committee has been appointed by the Arlington Horse-Railway Company to confer with the Cambridge Street-Railway Company with regard to proposed arrangement between the companies.

The Lynn Street-Railway Company has purchased the line and interests of the Stoneham Street-Railway Company. The line will be extended from Melrose Highlands (on the B. & M. R. R.) to Lynn, by way of East Saugus. The line will also be extended from Stoneham Center to Woburn. Charters have been granted. Mr. John Hill, superintendent of the Stoneham Company, will have charge of the new company.

The Globe Street-Railway Company, of Fall River, has decided to increase its capital stock $100,000, aggregating $300,000.

The Adams Street-Railway Company will extend its

tracks to the foot of Grove Hill, crossing the Boston & Albany Railroad by a new bridge.

The United States Pump & Valve Company, manufacturers of the Pearson noiseless steam motors for street-railways, is building a factory at Saugus. The company has its headquarters at 28 Oliver street, Boston.

The Metropolitan Railway Company, Boston, proposes to extend its tracks along Boylston and Dartmouth streets to West Chester Park; also to lay tracks on Water street and an additional track on Essex street.

The South Boston Railway Company proposes to lay a single track on West Broadway, from Harrison avenue to Washington street, and to run over the Metropolitan line on Washington between West Broadway and Beach street.

The West End Street-Railway Company, Boston, proposes to build a seven mile line from Marlboro street through West Chester Park and along Beacon street to the city line at St. Mark's street, Brookline. Several prominent residents on Beacon street favor the project. Beacon street would be widened to the dimensions of Commonwealth avenue, and a new bridge built over the Boston & Albany Railroad. By thus widening the street the driving facilities will not be lessened, the tracks occupying the center of the street with a sidewalk, row of trees and carriage driveway on each side. The road will be operated on the cable system.

MICHIGAN.

The Ann Arbor Street-Railway Company has been incorporated at Ann Arbor by Zina P. King and others. Capital, $25,000.

At Detroit, the Fisher Electric Railway, from Woodward avenue to Highland Park, is working satisfactorily. The cars carry 40 passengers each at a speed of 15 miles per hour.

MINNESOTA.

According to reports, the soda motors at Minneapolis are not satisfactory. They were introduced on account of steam motors being prohibited in the city. They are fine machines, but are not efficient in operation. The plant for charging cost $25,000, and the motors $8,000 each; a considerable amount of pressure during charging is lost by back pressure, and there is a good deal of noise.

MISSOURI.

At Kansas City, a petition is being circulated for a cable or electric street-railway on Prospect avenue from Ninth street to the southern city limits. W. H. Knott, T. J. Green and O. C. Day are interested.

The Metropolitan Street-Railway Company, of Kansas City, has obtained a franchise for a cable road which they propose to build next spring. Among those interested are Gen. C. W. Blair, Col. C. F. Morse and W. J. Ferry.

The engine house of the new electric railway at Kansas City was burned November 1st, delaying operations for about one month.

NEW JERSEY.

The Orange Cross-Town & Orange Valley Horse-Railway Company has accepted the provisions of the ordinance granting them the right to build the line.

At Elizabeth, an electric street railway is projected to the North Elizabeth depot, and from the Union depot to Elizabethport, to compete with the Newark & Elizabeth Horse-Railway Company.

NEW YORK.

Another trial of the Sprague electric motor has been made on the Thirty-fourth street branch of the elevated railway.

A cross-town road is projected on Twenty-eighth and Twenty-ninth streets, New York City.

An experimental trial of the Whites' compressed-air cable-grip, with power brake and automatic appliances, was made October 18th on the Tenth Avenue Cable Railway, New York City.

Representatives of the Third Avenue Railway Company have visited Providence, R. I., to inspect the Bentley-Knight electric motors. The motors are to be experimented with on 125th street.

The Brooklyn & Coney Railroad Company will rebuild the line from the city limits to the shore. The stockholders have decided to adopt mechanical traction, and petroleum and steam-motors are to be tried.

The Park Avenue Cable road, Brooklyn, is being pushed by the contractors, T. L. Johnson and E. I. Dupont. The necessary powers have been obtained for continuing the line to Fulton Ferry.

The South Brooklyn & Flatbush Railway Company has been incorporated by Thomas McGrath and others. Capital, $500,000.

The commissioners appointed by the Supreme Court in the behalf of the Union Elevated Railway Company, have inspected the routes and completed all the work preparatory to rendering a decision.

An electric railway is projected between Cedarhurst, the Isle of Wight and Far Rockaway, L. I.

A street-railway is to be built between Waverly and Athens. Work is progressing on the street-railway at Yonkers, and it will be soon completed.

At Albany, there is talk of the purchase of the street-railway system by a cable railway company. It is expected that cable lines will be in operation on State street and Washington and Central avenues within a year.

OHIO.

At Cleveland, the Broadway & Newburg Street-Railway Company, having failed to secure a majority of frontage on Orange street, has failed to obtain right-of-way.

At Springfield, the Plum street line will be built this season. The contract for 56 tons of steel rails was awarded to the Cambria Steel Company, of Johnstown, Pa., and for 40,000 feet of oak ties to Stewart & Co., Springfield.

PENNSYLVANIA.

The Union Electric Company's car that has been running on Ridge avenue, Philadelphia, has proved very satisfactory.

An elevated electric railway is projected for West Park, Philadelphia.

At Lancaster, the right-of-way has been granted for a new street-railway to the East End Passenger Railway Company; it will probably not be built till spring.

TENNESSEE.

At Nashville, the Main Street & Lisbey Avenue Street-Railway Company has been organized by T. W. Crutchen and others.

The Edgefield & Nashville Street-Railway Company has commenced work with a force of about 150 hands.

Manufactures.

THE ROGERS LOCOMOTIVE AND MACHINE WORKS.

(Continued from page 249.)

CHAPTER V.

THE ORGANIC DEVELOPMENT OF THE LOCOMOTIVE.

GRATES.

WITH very few exceptions, the fuel used in the early locomotives in this country was wood. This could be burned successfully with an ordinary "plain" grate, as it was called, consisting of narrow bars with spaces about ½ inch wide between them. Figs. 64 and 65 show a grate of this kind, which was used in 1840. The bars were

Fig. 64.

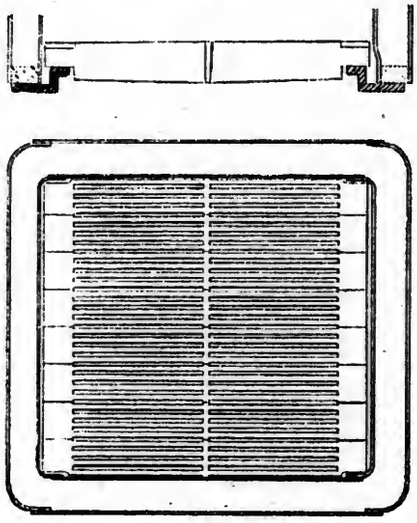


Fig. 65.

made of cast-iron, the material of which locomotive grates are almost universally made in this country. Figs. 66 and 67, however, represent a grate made of wrought-iron bars, bolted together in groups of four bars each. The use of wrought-iron bars is, however, an exception to the general practice in this country. The grate shown in the figures last referred to has a drop-door D at the front end. This is hinged at B and is held up by the arms A A, on the shaft S. To drop the door, the shaft is turned by the lever on the end of the shaft, which lowers the arms A A and allows the door to fall.

As much of the bituminous coal in this country contains a great deal of material which causes it to clinker, or otherwise interferes with its free combustion, it has been found essential to provide locomotives with what are called shaking grates for "clearing the fire." A number of different grates of this kind, which have been applied to locomotives at the Rogers Works, are shown by the following engravings:

Figs. 68 to 71 represent the Allen & Hudson grate, which was patented by Mr. Albert J. Allen and William S. Hudson in 1858. The grate is composed of a series of cast-iron bars with lugs on their sides, as shown in the plan. Underneath the bars are two cast-iron rocking-shafts, S S', which have arms *a a'* and *b b'* on their opposite sides. Each grate-bar has two projections *c c'* and *d d'* on its under side. To make it clear how the grate operates, it may be explained that the bar B B, shown in Fig. 69, has the two projections *c c'* attached to it, and that the projections *d d'* are attached to the bar next to B B. The projections *c c'* are connected by pins to the arms *a a'*, and *d d'* are attached to the arms *b b'*. It is obvious then, that when the shafts S S' are rocked, that the arms *a a'* will rise, and *b b'* will fall simultaneously, and *vice versa*, and that the grate bars connected to these arms will have a corresponding movement. As the alternate bars which compose the grate are connected to the arms on the right side of the shafts S S, and the bars between them are connected to the arms on the left

Fig. 66.

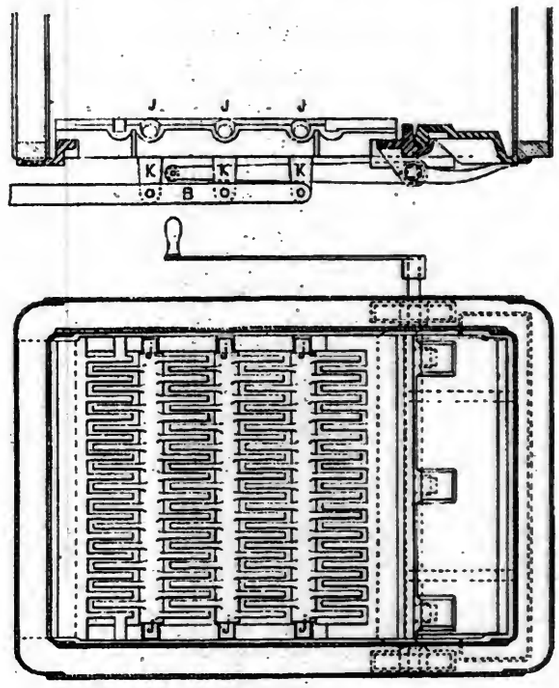


Fig. 67.

side of the shafts, it is plain that the working of these shafts has the effect of giving a limited upward and downward movement to the bars, in which each bar ascends as the next one on either side of it descends, and *vice versa*. This movement has the effect of breaking up the clinkers or other foreign or residuary matter that may collect upon the grate, and which tend to choke the draft between the bars, and to cause such matter to work down between the bars into the ash-pan, and also serves to evenly distribute the fuel over the grate.

The working of the shafts S S' is effected by means of the lever L, which is connected by a bar, F, to vertical arms, *f f'*, attached to the under side of the shafts. The grate is also provided with a drop door.

Figs. 72 and 73 represent what is called a "finger" grate, which consists of cast-iron shafts, with projections or fingers on each side. These shafts rest in journals, *j j j'*, and are rocked by a lever (not shown in the engraving)

and bar B, the latter connected to vertical arms, K K K, attached to the shafts. It is obvious that, as the shafts are rocked, the fingers on one side rise, and those on the opposite side fall, and that the effect will be to thoroughly shake up the fire. Figs. 74 and 75 represent another form of finger grate. Both the forms illustrated were first used in 1860.

Figs. 76 to 89 represent various forms of "rocking" grates, as they are called. These have transverse grate bars, with journal bearings at each end, similar to those of the finger grates. The bars are rocked on these journals, which has an effect similar to that of the finger grate in stirring up the fire. The construction and action of these grates will be obvious from the engravings.

Fig. 68.

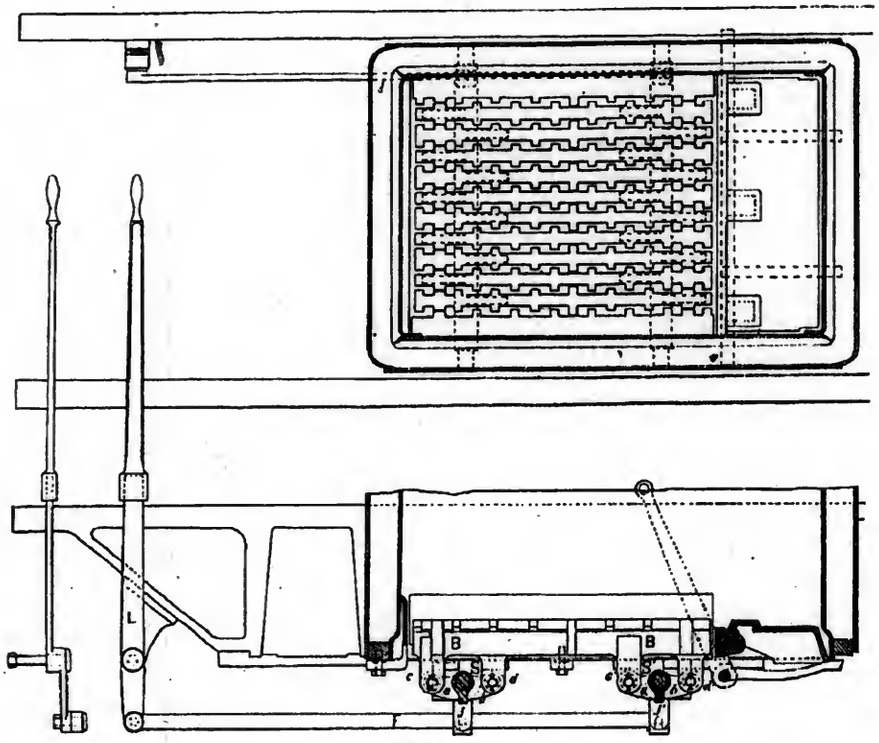


Fig. 69.

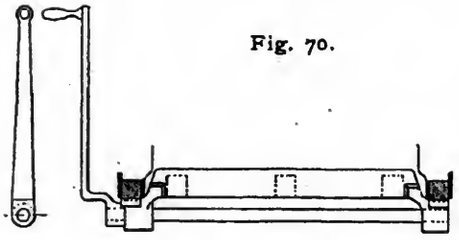


Fig. 70.

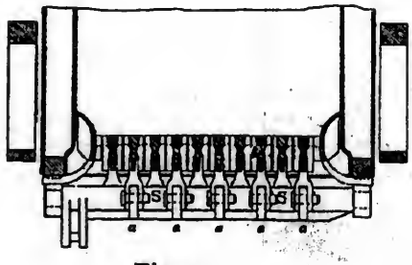
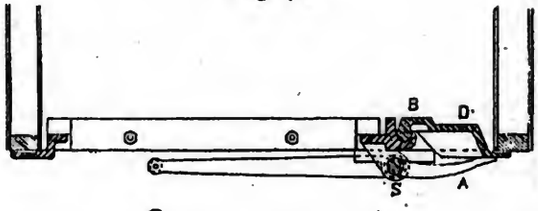


Fig. 71.

Fig. 72.



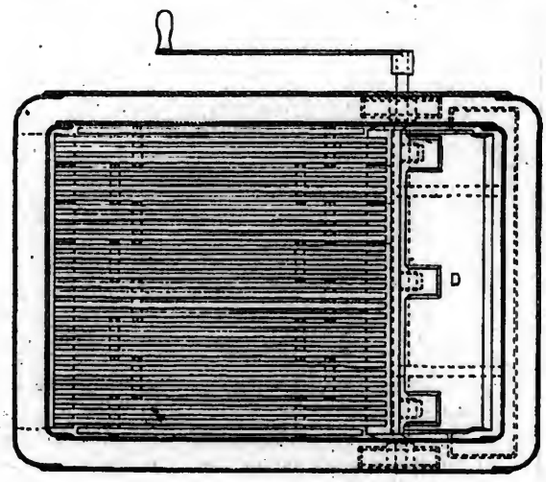


Fig. 73.

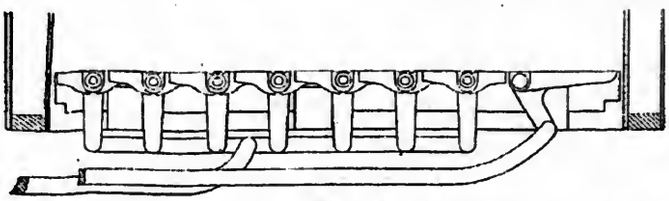


Fig. 74.

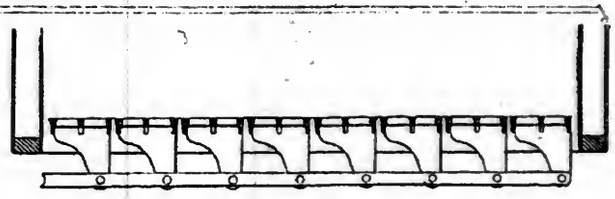


Fig. 76.

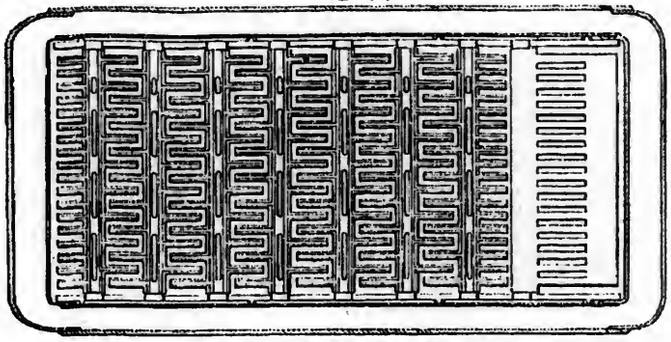


Fig. 75.

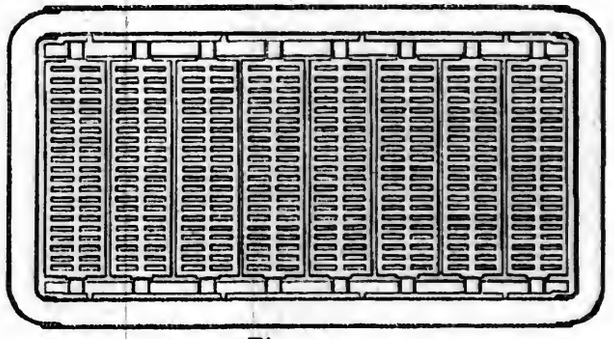


Fig. 77.

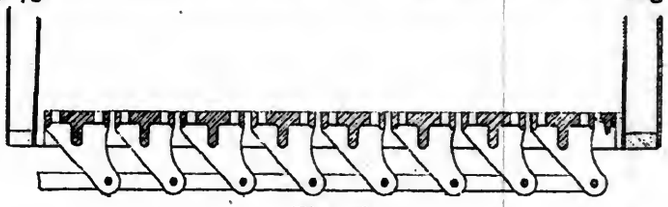


Fig. 78.

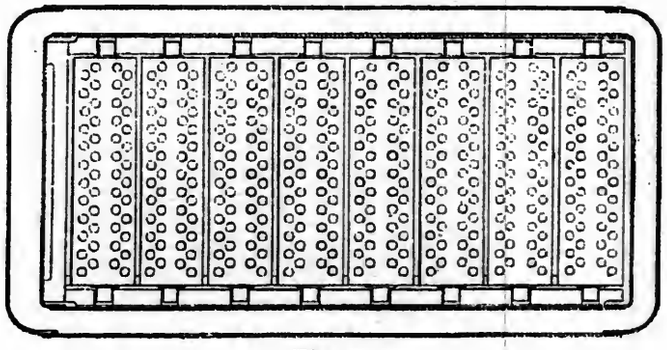


Fig. 79.

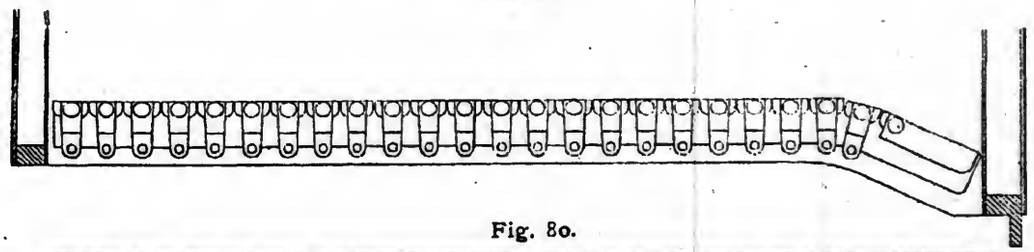


Fig. 80.

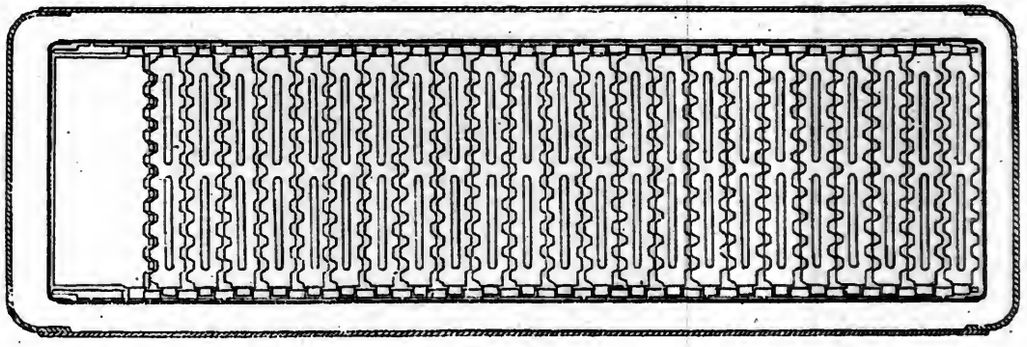


Fig. 81.

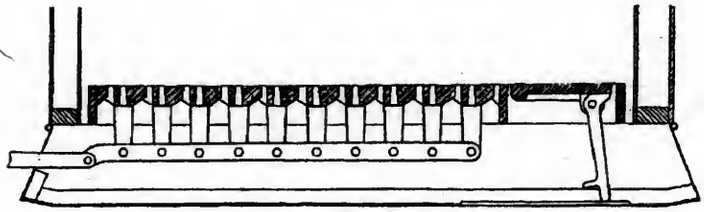


Fig. 82.

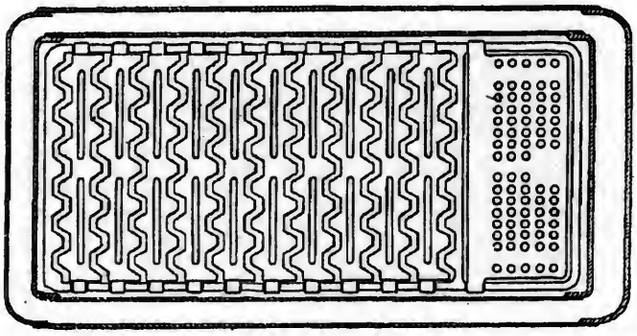


Fig. 83.

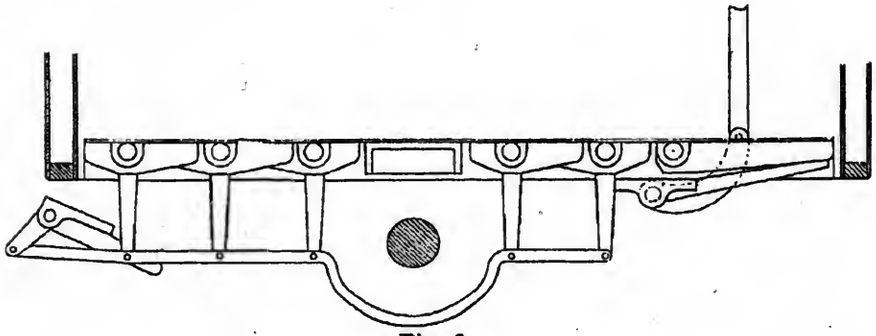


Fig. 84.

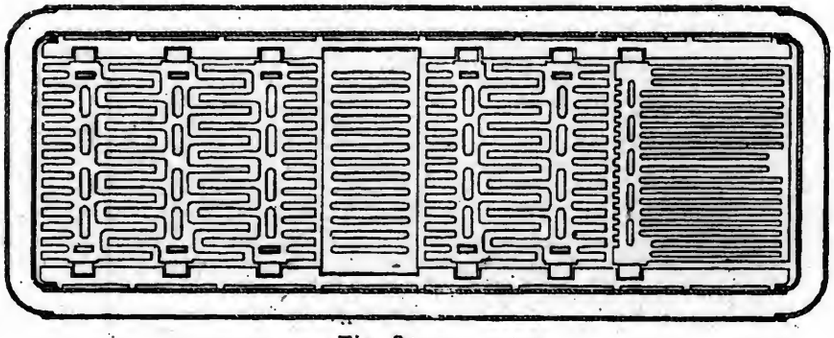


Fig. 85.

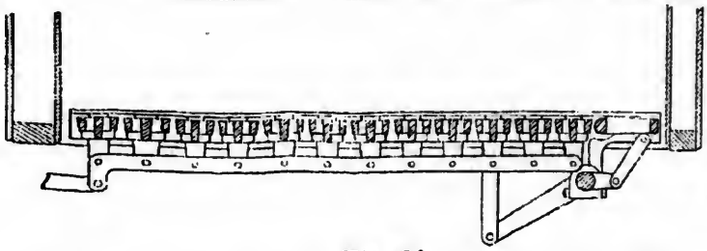


Fig. 86.

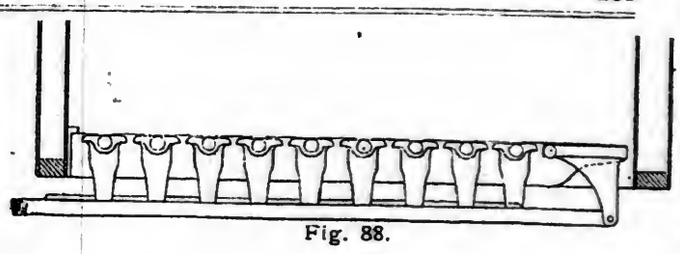


Fig. 88.

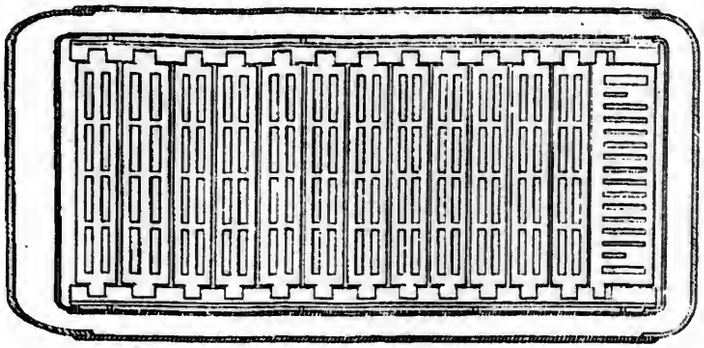


Fig. 87.

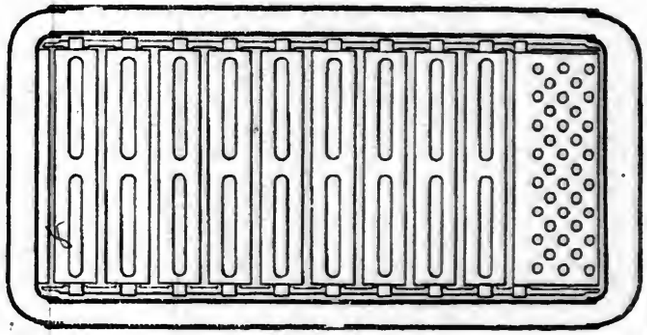


Fig. 89.

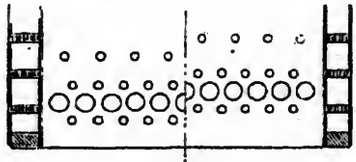


Fig. 91.

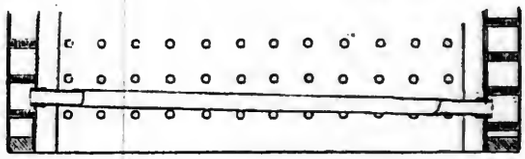


Fig. 90.

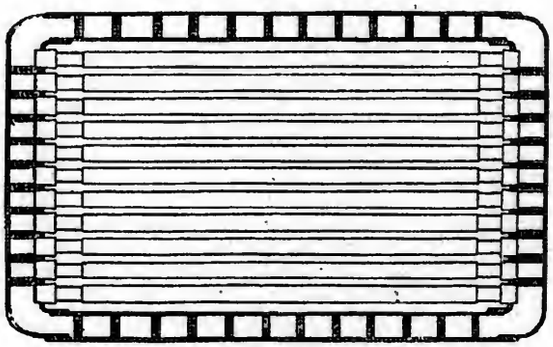


Fig. 92.

For burning anthracite coal the water-tube grate is almost universally used. The form used on the Philadelphia & Reading Railroad is shown in Figs. 30 and 31. The tubes are put in as shown in Fig. 31. Solid bars, B B, are substituted for every fourth tube. These bars pass through thimbles, T, Fig. 30, in the back end of the fire-box, and can be drawn out through this thimble to clean or remove the fire.

Figs. 90, 91 and 92 represent a water grate, recently introduced, to burn bituminous coal.

(*To be continued.*)

The Whitecross-Street Goods Station.

THIS is one of the city warehouses for the receipt and delivery of goods carried by the Midland Railway. The machinery is worked by hydraulic power; and the engines, boilers, hoists, cranes, etc., employed to do the work, are as follows: There are two pairs of horizontal direct-acting hydraulic pumping engines; one pair has 18-inch cylinders with 30 inches stroke, and the other pair has 16-inch cylinders with 22 inches stroke. Three boilers of the locomotive type: cylindrical part 10 feet 6 inches long, and 4 feet 4 inches in diameter; fire-box shell, 5 feet 6 inches long. Each boiler has 150 tubes of 2 inches in diameter, with a heating surface of 853 square feet; heating surface of fire-box 94 square feet; total heating surface 947 square feet. Fire-grate area, 18 square feet. Steam pressure, 100 pounds per square inch. Two hydraulic accumulators: one has a ram 24 inches in diameter and 20 feet stroke; the other has a ram 18 inches in diameter and 20 feet stroke; water pressure, 720 pounds per square inch. Nine hydraulic platform-cranes: of which two lift 50 cwts. each, five lift 25 cwts. each, and two lift 20 cwts. each. Two hydraulic wagon-hoists, each lifting 20 tons; three cage-hoists, each lifting 20 cwts.; six jigger hoists, each lifting 30 cwts.; total number of hoists, 11. Fifteen hydraulic capstans, each having a hauling power of 1 ton. Five wagon-traversers, of which two are worked by hydraulic cylinders, and the other three by the capstans. The pressure main from the engine-house to the warehouse is 6 inches, internal diameter. The exhaust water from the machines is returned to a tank in the engine-house to be used over again.—*Iron.*

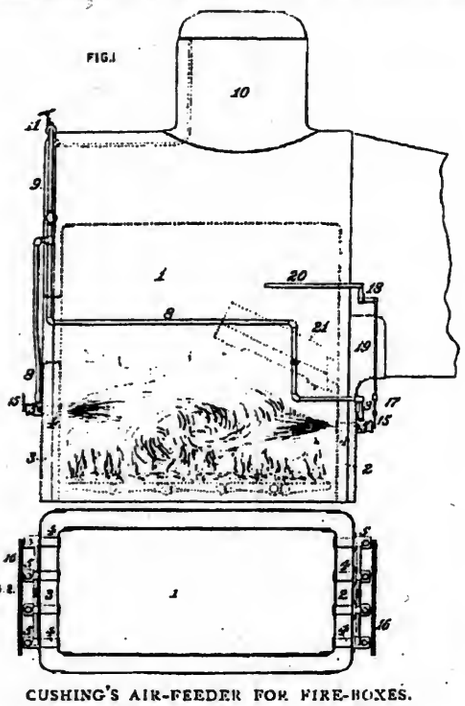
AT Littlehampton, England, an electric railway similar to the one on the Volk system successfully operated at Brighton, is to be laid on the Esplanade.

New Inventions.

Cushing's Air-Feeder for Fire-Boxes.

MR. GEO. W. CUSHING, Superintendent of Machinery on the Northern Pacific Railroad, has recently patented devices for promoting and perfecting combustion in fire-boxes, by the introduction of steam-induced currents of air. Air-supply tubes, 4 4, Figs. 1 and 2, are placed in the front and back ends of the fire-box. On the outer end of each of these tubes there is an air and steam chamber or casing, 5—shown on a larger scale by Figs. 3, 4 and 5—which is attached to the fire-box by bolts passing through lugs on flanges 6.

A steam-jet pipe or nozzle, 7, having its outer end threaded or otherwise suitably adapted to be connected to a steam-pipe, is cast upon each of the chambers 5, said



CUSHING'S AIR-FEEDER FOR FIRE-BOXES.

jet-pipes being bent at right angles, as shown by dotted lines in Fig. 3, so that their inner ends shall be central with the chambers and supply-tubes, and having their discharge ends projecting a short distance beyond the inner ends of the chambers, so as to deliver steam into the supply-tubes. The jet-pipes 7 are connected by pipes 8, Fig. 1, with a steam-supply pipe, 9, leading from the dome 10, or other suitable portion of the steam-space of the boiler, and provided with a regulating-valve, 11, for governing the admission of steam therefrom. A hollow or tubular cylindrical air-valve, 12, is fitted, with the capacity of axial movement, in the outer end of each of the chambers 5, the outer ends of which are closed by said valves. Air-supply inlets or openings, 13 (one or more), are formed in that portion of the shells of the chambers which incloses the valves, and corresponding openings, 14, are formed in the valve in the same longitudinal plane as the openings 13 of the chambers, so as to be adapted to register therewith when the valves are rotated into position therefor.

It will be seen from the above construction that the admission of air to the chambers and supply-tubes may be regulated to any desired degree, or entirely stopped, as desired, by proper movements of the air-valves. An arm, 15, is fixed upon the outer end of each of the air-valves 12, and the arms 15 of each series of valves—to wit, those on the front and the back of the fire-box, as well as those on the sides, if such are employed—are coupled by rods or links 16, so as to be moved simultaneously in opening or closing the air-admission inlets. The links 16 are in turn connected by bell-crank levers 17, 18

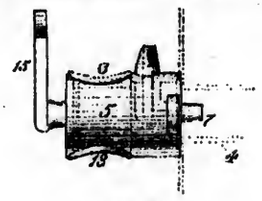


FIG. 3.

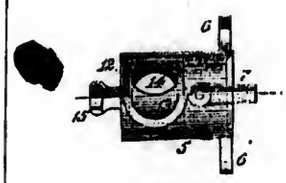


FIG. 4.

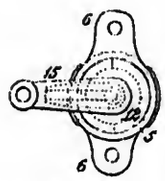


FIG. 5.

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and links 19 with operating-rods 20, which extend to any convenient position within reach of the engine man on the foot-board.

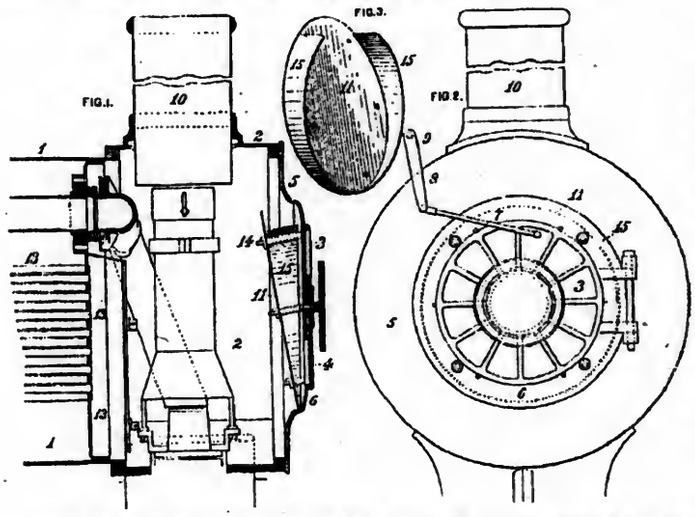
In describing his invention the inventor says further: "My improvements are herein shown as applied only to the front and rear of the fire-box, and such application will usually be found sufficient. It will be obvious, however, that, if desired, similar series of supply-tubes and their accessories may be employed upon the sides as well as the ends of the fire-box. I have developed, in practice, highly satisfactory results in the prevention of smoke and increase of draft by the use of my improvements, and have further found them specially desirable and effective in connection with a brick arch, 21, Fig. 1, in the fire-box, of the construction set forth in my Letters Patent No. 333,202, December 29th, 1885."

Wootten's Improvement in Smoke-Boxes of Locomotive Boilers.

MR. JOHN E. WOOTTEN, General Manager of the Philadelphia & Reading Railroad, has taken out a patent for a combination with the smoke-box of a locomotive boiler, of a register or damper controlling one or more air-admission openings in the smoke-box front or door, and a baffle-plate or deflector interposed between said openings and the tube-sheet in such position as to direct entering currents of air into the stack, without permitting their contact with the tube-sheet and tubes. The invention is more particularly designed for application in locomotive boilers with the large fire-boxes patented by Mr. Wootten, in the operation of which, by reason of the free and rapid steam-generating capacity, due to their large area of grate

and heating surface, the supply of steam may, from time to time, as in the case of sudden and unexpected stoppages on the road, or diminution of load, or speed, etc., exceed that demanded for the time being, in which case it is desirable to provide proper means for temporarily reducing the intensity of the fire, and thereby the generation of steam, to obviate undue pressure in the boiler and corresponding waste of fuel.

The smoke-box 2 is provided with a movable and adjustable register, or damper 3, governing one or more air-admission openings, 4, in the forward end of the smoke-box, which openings may be either located in the smoke-box front 5, or, preferably, as shown, in the door 6, by which access is afforded to the interior of the smoke-box. The register 3 is pivoted or journaled to the door 6, or otherwise suitably fitted to slide or vibrate over the air-admission openings 4, so as to uncover, to a greater or less degree, or completely close the same, as required, being moved by means of a link, 7, by which it is coupled to an arm, 8, fixed upon a shaft, 9, which extends to any convenient



WOOTTEN'S IMPROVEMENT IN SMOKE-BOXES OF LOCOMOTIVE BOILER.

position within reach of the engineman in the cab. By uncovering the air-admission openings 4, currents of air are drawn freely through the same into the smoke-box and out through the stack 10, with the effect of immediately checking the less free draft through the tubes, and correspondingly reducing the intensity of the heat in the fire-box, and the generation of steam therefrom.

When the air entering the smoke-box is allowed to come in contact with the heated tube-sheet, it causes leaks around the front ends of the tubes by the sudden cooling and contraction of the same. To obviate this a baffle-plate or deflector, 11, is interposed between the air-admission openings 4 and the tube-sheet 12, the baffle-plate being so located as to upwardly deflect the entering currents of air, and prevent their contact with the tube-sheet 12 and tubes 13 fixed therein. The baffle-plate 11 is in the form of a sheet-iron disk, which is set with its lower portion at a short distance from the smoke-box door, and is rearwardly inclined toward its top, so as to afford a sufficient area of opening at and near the same for the passage of the air from the openings 4 to the stack. It may be secured in position in any suitable manner, and, as shown, is connected by a series of socket bolts or studs, 14, to the smoke-box door 6, so as to swing outwardly with the same when opened, and thus obviate obstructing the opening in the front, and, being entirely in advance of the exhaust-nozzle and stack, it presents no impediment to the draft when the register is closed.

In order to more thoroughly fulfill its function, the baffle-plate may, if desired, be provided with a circumferential rim or casing, 15, extending around its lower and side portions, and terminating at such distance below its top as to leave a sufficient area of discharge opening thereat. The rim or casing substantially closes the space between the outer portion of the baffle-plate and smoke-box front, except at its upper discharge opening, and thus effectually prevents any contact of air with the tube-sheet by the passage thereof laterally behind the baffle-plate, and that which passes out through the upper discharge opening tends naturally only in the direction of the stack, through which it escapes.

Train Signaling by Electricity.

WRITING to the *Morning Post*, Mr. Charles Pridham, vice-chairman of the Electric Signal Company, says: "Nearly two years since you kindly gave insertion to a letter of mine respecting train signaling by electricity, in lieu of fog-signals and steam whistles. The letters that are now appearing in the *Standard* respecting the latter nuisance, prompt me to beg space for the following statement: Since I last wrote you, we have so much simplified the arrangements for train communication, that by merely making and breaking an electric circuit, signals to proceed or stop are exhibited to the engine-driver by a semaphore on his engine, and conversely the driver can ask, 'Line clear?' of the signalman. I may add that Dr. Hopkinson, Mr. Cooper, engineer to the Belfast Central Railway, and Mr. Woods, engineer to the railway at Tenby, have seen the invention at work, and testified to its value. The former reports of Enright's electric signals: 'I carefully verified the working of every part of the apparatus, both from the point of view of the signalman at the station, and from the point of view of the driver on the locomotive. In my presence every part of the apparatus performed perfectly, the signals on the locomotive were unmistakable, and the contacts were properly recorded on the drum at all speeds up to 50 miles per hour, the maximum it was practicable to obtain.'"